MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 36 MARCH, 1930 Number 7

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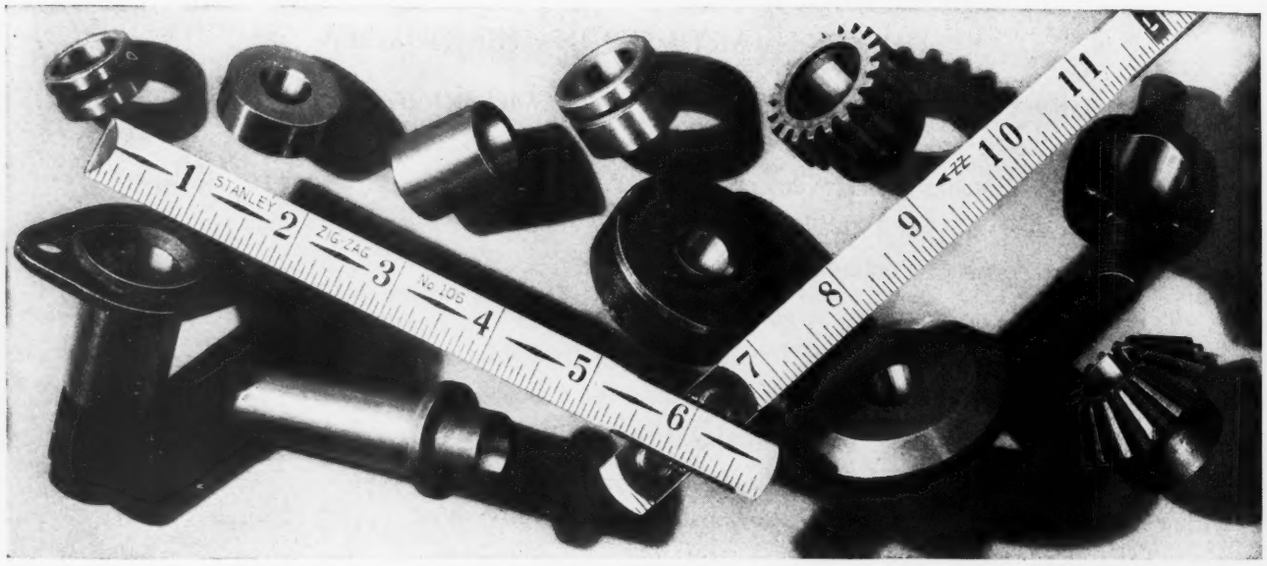

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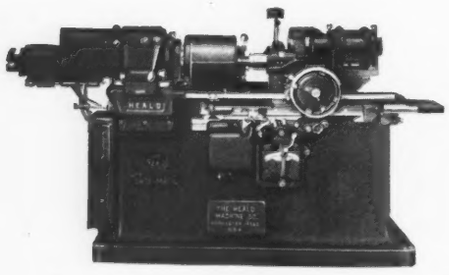

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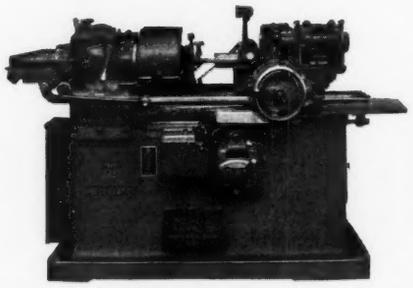

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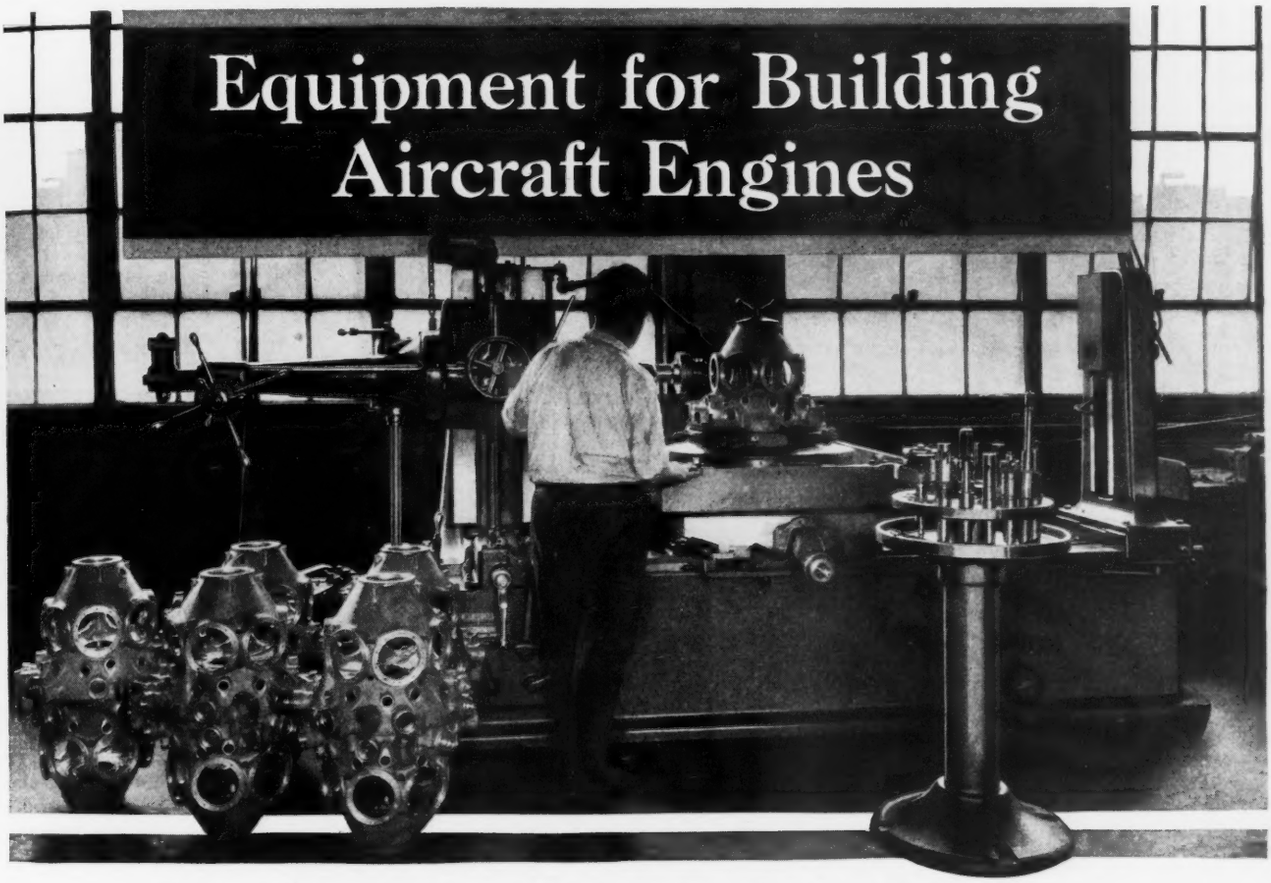
Volume 36 NEW YORK, MARCH, 1930 Number 7

Equipment for Building Aircraft Engines



Typical Shop Equipment Recently Installed for the Manufacture of Continental Air-cooled Radial-type Engines

By CHARLES O. HERB

FOR more than a quarter of a century the Continental Motors Corporation has specialized in the building of gasoline engines by quantity production methods. First, engines were built for passenger automobiles only, and then, as the motor truck became a vital factor in the solution of transportation problems, engines of greater capacity were manufactured for this field. Still later, engines were developed for marine use and for such industrial service as driving contractors' equipment and electric welding sets in localities where electricity is not available.

This concern has recently entered the aviation field through its subsidiary, the Continental Aircraft Engine Co., which has introduced on the market a seven-cylinder, radial-type, air-cooled engine that has received a rating of 165 horsepower at 2000 revolutions per minute from the United States Department of Commerce. The cylinders have a bore of 4 5/8 inches and the pistons a stroke of the same dimension, giving a total piston displacement of 544 cubic inches. The latest types of machine tools, examples of which are shown in the accompanying illustrations, have been installed in a separate division of the Detroit plant for manufacturing this engine by interchangeable methods.

Interesting Facts About the More Important Engine Parts

The seven cylinders consist of forged carbon-steel barrels on which heat-treated aluminum alloy heads are screwed and shrunk. The barrel bores are ground to between 4.624 and 4.625 inches for a length of 8 1/4 inches. Each cylinder unit is secured to the crankcase by means of ten studs and nuts. An important feature of this assembly is that all cylinders must be mounted on the crankcase in the same vertical plane within very close limits.

Two heat-treated aluminum alloy castings which are joined on the center lines of the cylinders make up the crankcase. The front portion carries a ball thrust bearing and a roller bearing for the crank-

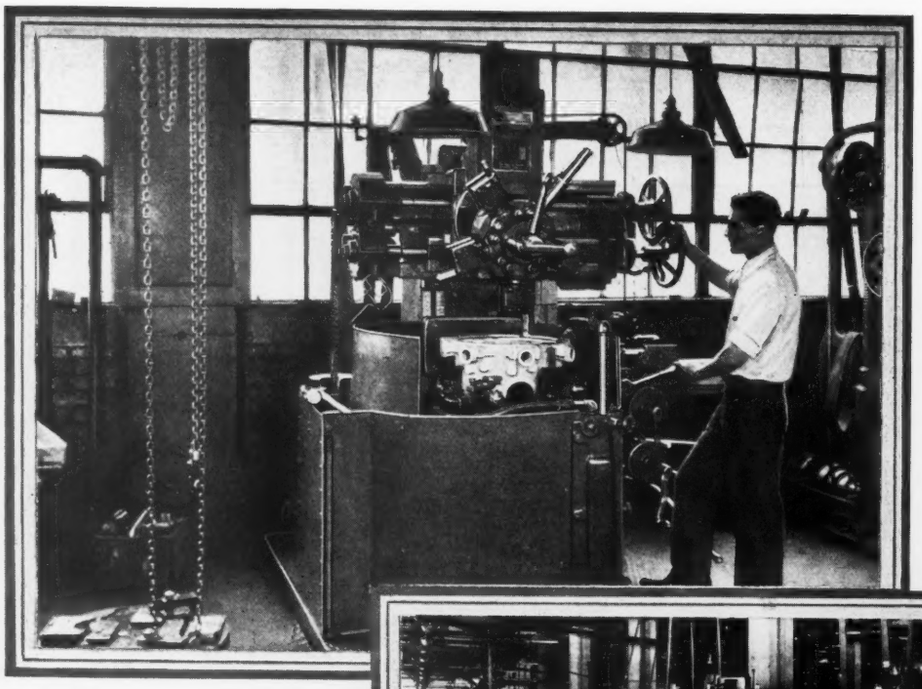


Fig. 1. Standard machine tools are used throughout the Continental Aircraft Engine Co.'s plant to meet the requirements in case other engine types are brought out and to permit any changes in manufacturing methods that may be deemed advisable. The vertical turret lathe shown to the left is used on such parts as front and rear crankcase castings. In the operation illustrated, the rear crankcase rim is being bored and faced, several pads are being faced, and two holes bored.

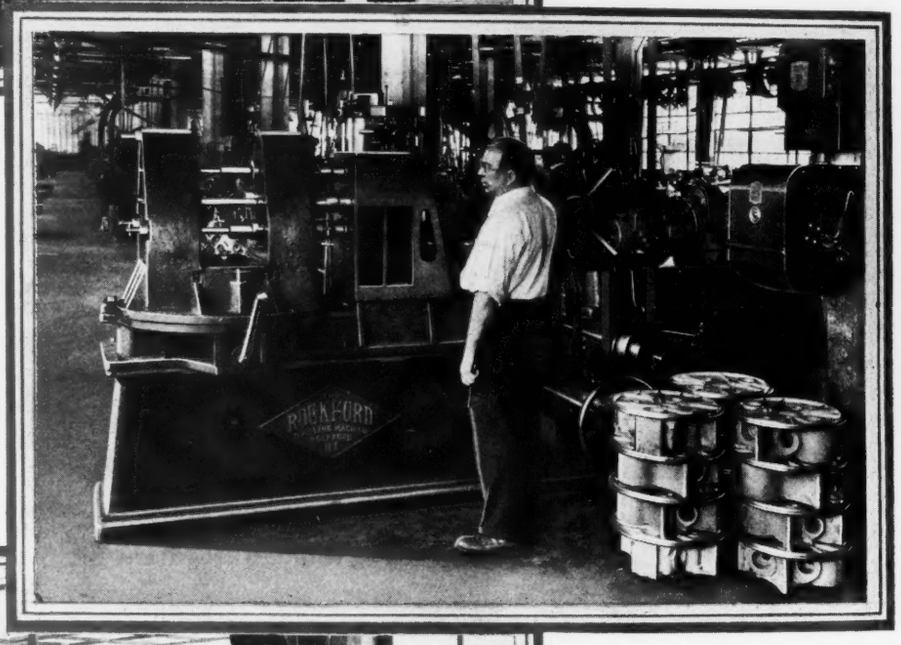


Fig. 2. A horizontal type of drilling and boring machine is used for such operations as rough- and finish-boring four holes in the accessory case and three crankshaft bearing holes in the crankcase. For the accessory case, eight toolbars are used, four taking the roughing cuts and four the finishing cuts.

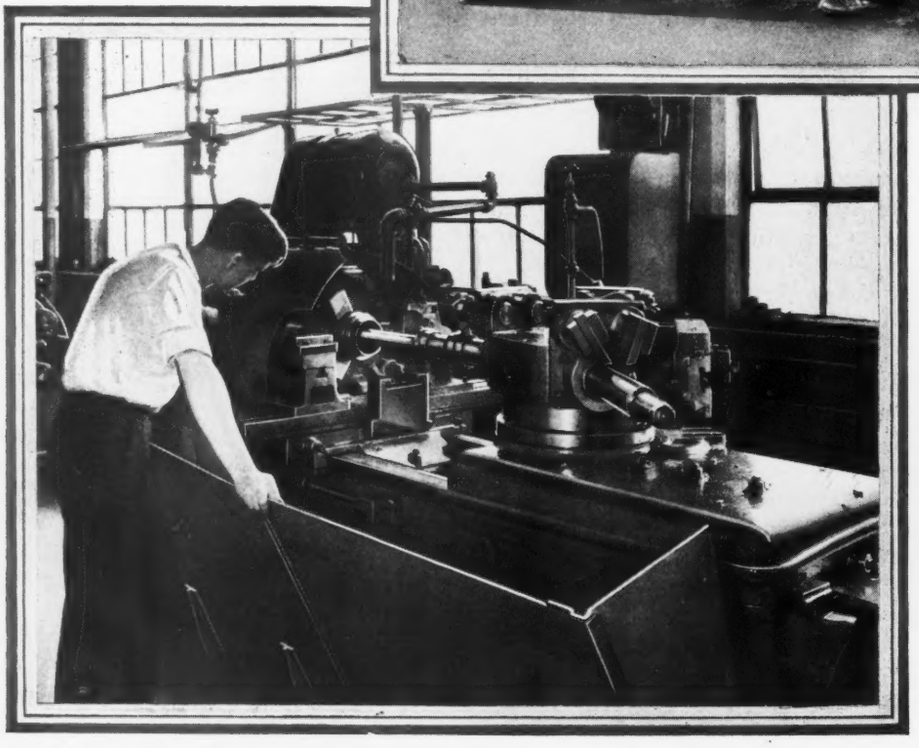


Fig. 3. Automatics tooled up for operation on a quantity production basis are employed for machining various parts. The machine shown to the left is used for boring the cylinder barrels and turning one end of these parts. These cylinder barrels are steel forgings on which the aluminum alloy heads are later screwed and shrunk. Master connecting-rods, cam rings, and many other parts are also bored and faced in the same kind of machine, including the combustion chamber in the cylinder head, where the spherical surface is bored as well.

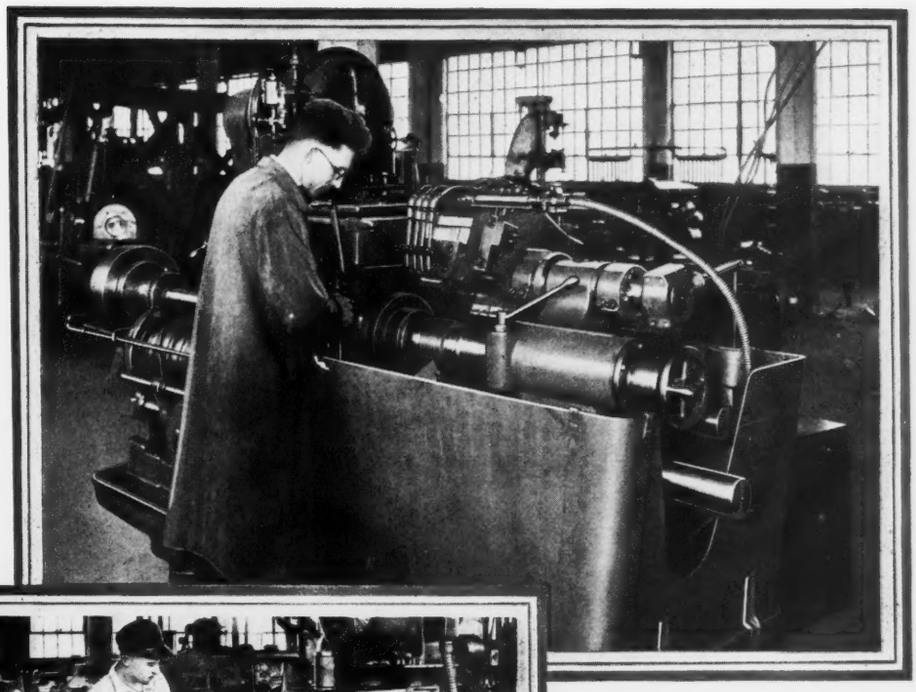


Fig. 4. An automatic lathe is used for turning the fins on the exterior of the steel cylinder barrels after the barrels have been completely turned and faced. Three sets of tools are provided on this machine. One set cuts the fins straight down to depth; a second set cuts them slightly tapered on one side; and a third set produces the taper on the opposite side. There are sixteen fins on each barrel. At the outer edge the fins are about 3/64 inch thick and they are approximately 5/8 inch deep.

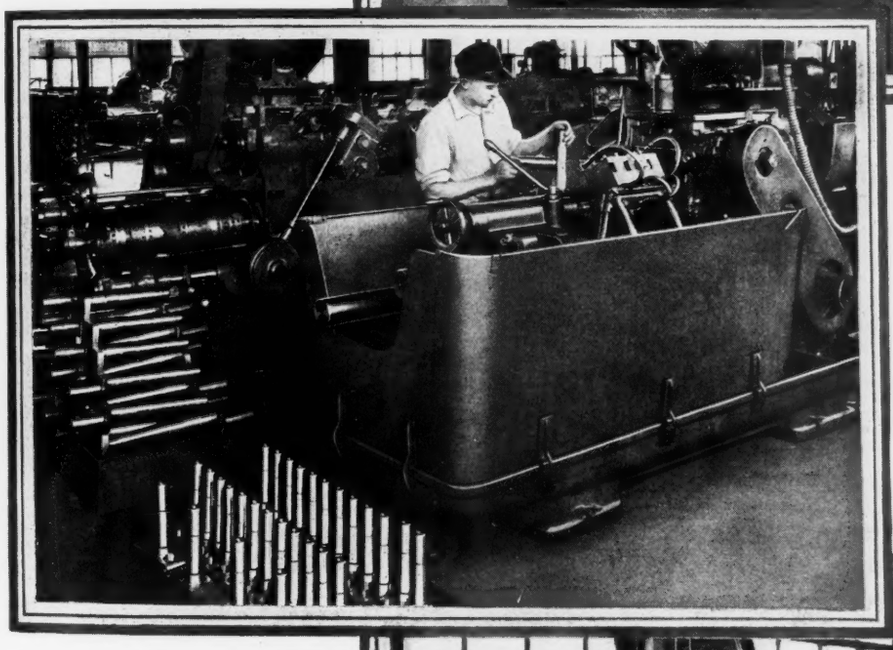


Fig. 5. Another automatic is tooled up for taking turning and facing cuts on the two chrome-nickel steel forgings that make up the crankshaft. The rear crankshaft pieces are seen on the floor in the immediate foreground of the illustration at the left; directly in back of these, there is a pile of the front crankshaft parts.

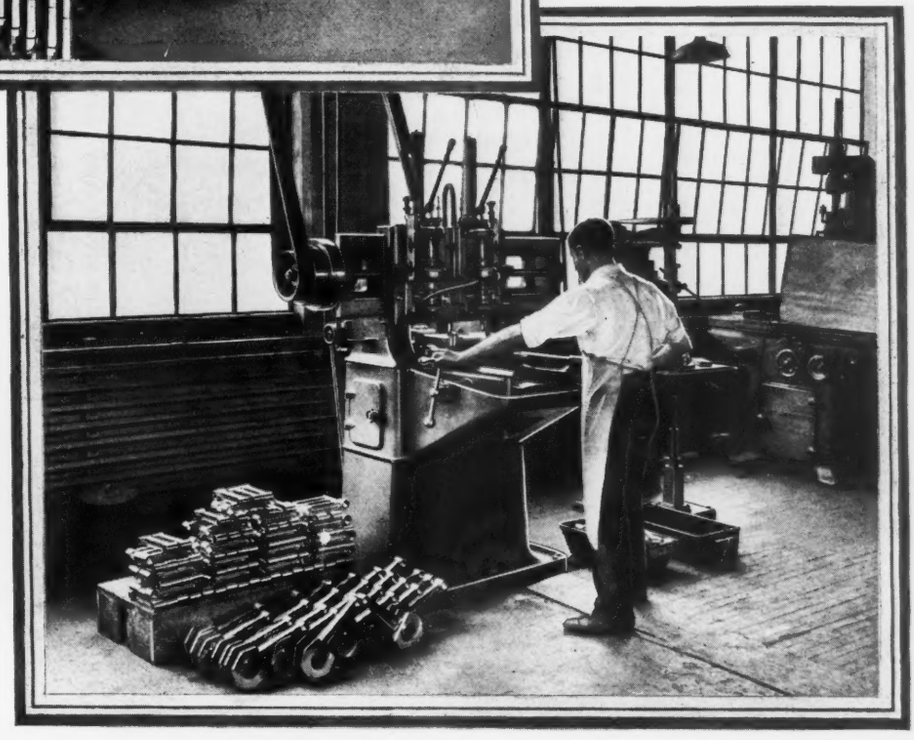


Fig. 6. Milling machines are used for finishing all external surfaces of the connecting-rods. The channels in the blades of both master and articulated connecting-rods are machined in the machine illustrated to the right; this operation is also shown in Fig. 11. The end-mill employed to cut the channel in the master connecting-rod is guided by a pilot which is in contact with a templet mounted on the table. As this templet is moved back and forth and the cutterhead is fed sideways, the end-mill cuts the channel to the desired outline.

Fig. 7. Holes in cylinder barrels, the hole in the rear crankshaft part, the master connecting-rod holes which receive the articulated rod knuckle pins, and the articulated connecting-rod holes are finished in the type of internal grinding machine shown to the right. In the operation illustrated, which consists of grinding the cylinder bores after the cylinder heads have been shrunk on the barrels, the bores are ground to between 4.624 and 4.625 inches, for a length of 8 1/4 inches.

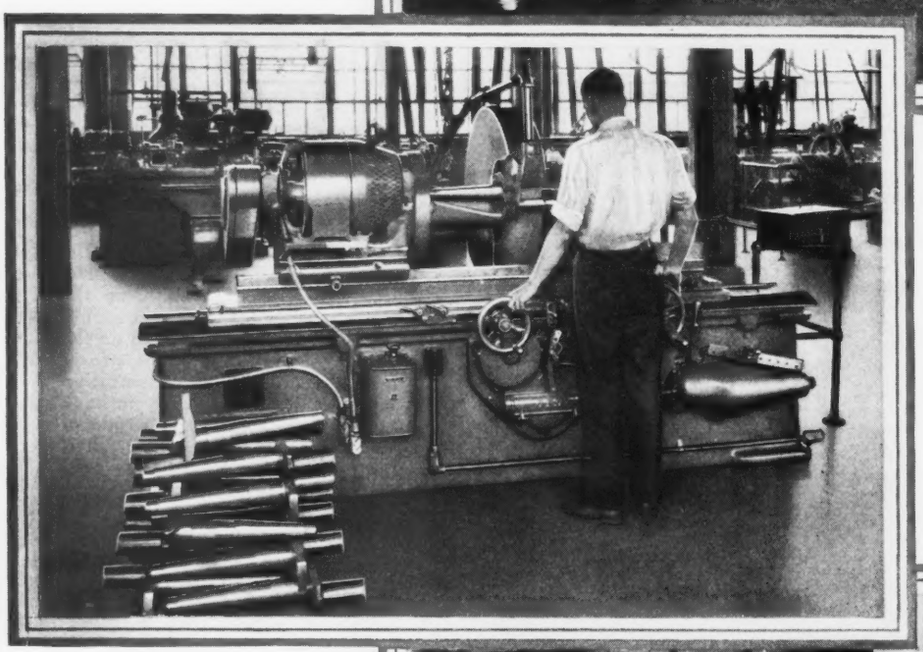


Fig. 8. Grinding machines are used for finishing the cylindrical surfaces of a variety of parts and for grinding the cheeks of the crankshaft pieces. The operation illustrated consists of finishing the crankpin which is on the front crankshaft piece. The outer end is assembled into a ground hole in the rear part.

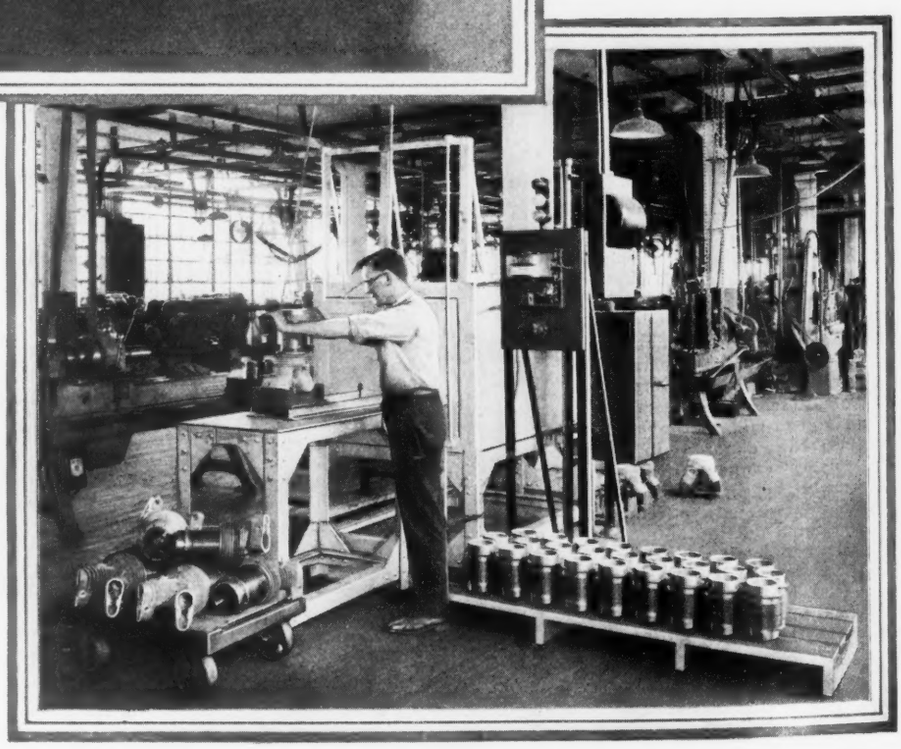


Fig. 9. After the aluminum alloy cylinder heads have been machined, they are screwed and shrunk on the steel barrels. Before this operation is performed, the heads are heated to a temperature of 500 degrees F. in the electric furnace equipment shown to the right. The shrinkage allowance is 0.012 inch. The operator is seen screwing a barrel into a head. Heat-treating equipment and a metallurgical laboratory for guarding the quality of all materials entering into the construction of the engine have been provided for the aviation division.

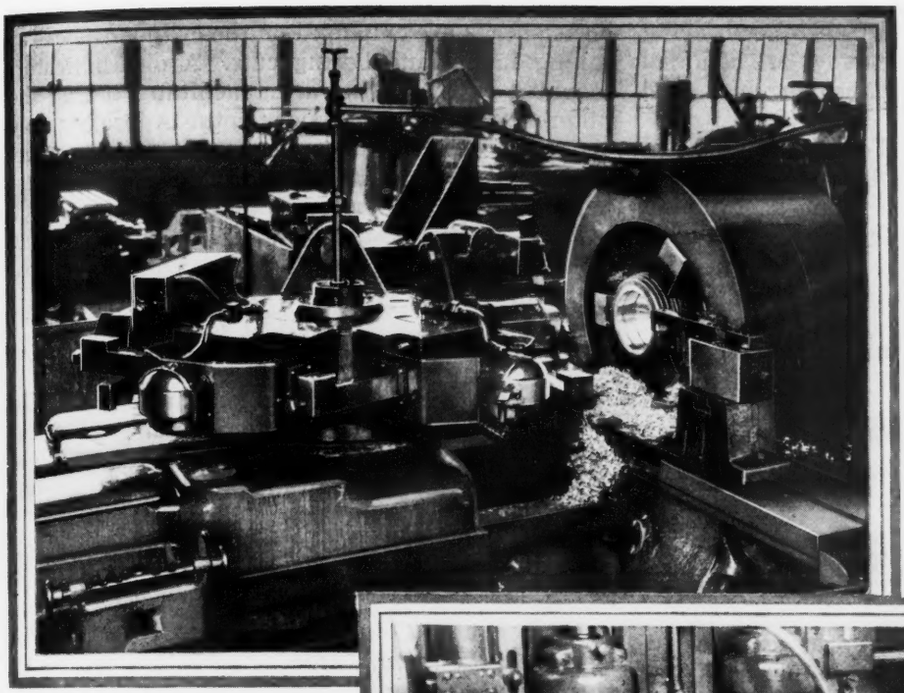


Fig. 10. The tooling equipment employed on an automatic for finishing the combustion chamber in the aluminum alloy cylinder heads is shown to the left. The spherical surface is rough- and finish-bored by employing cutters which are swiveled to suit the radius of the surface when the turret is fed toward the work. This swiveling is produced by means of a rack and pinion mechanism which is actuated by the cross-slide. A machine of the same type is shown in Fig. 3 for other operations.

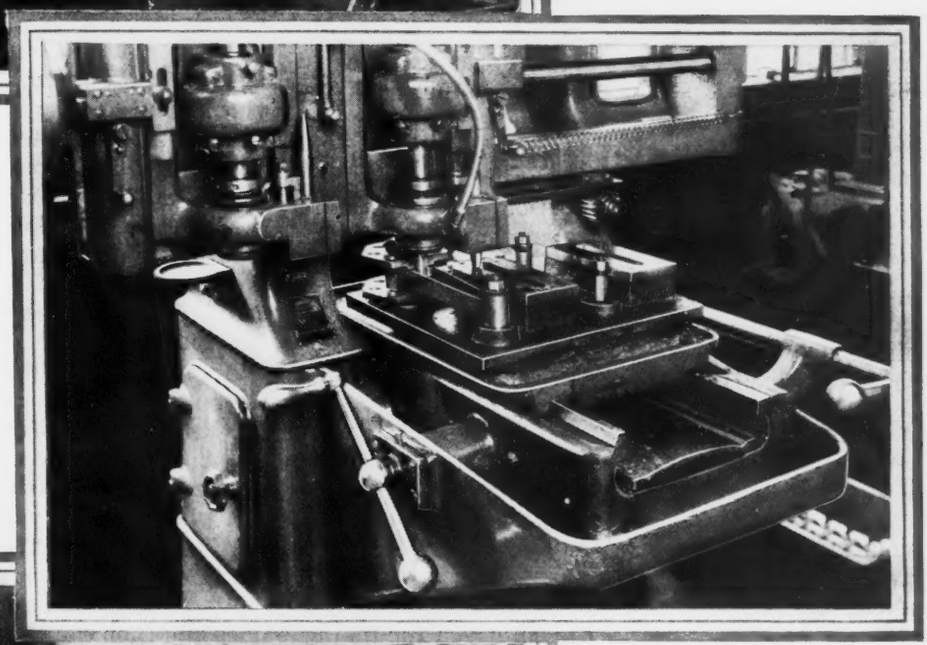


Fig. 11. Close-up view, showing the operation of milling channels in the solid blade of a master connecting-rod. The complete machine employed in this operation is illustrated in Fig. 6. The same machine is used for profiling the intake and exhaust pads of the manifold by using a suitable fixture and templet.

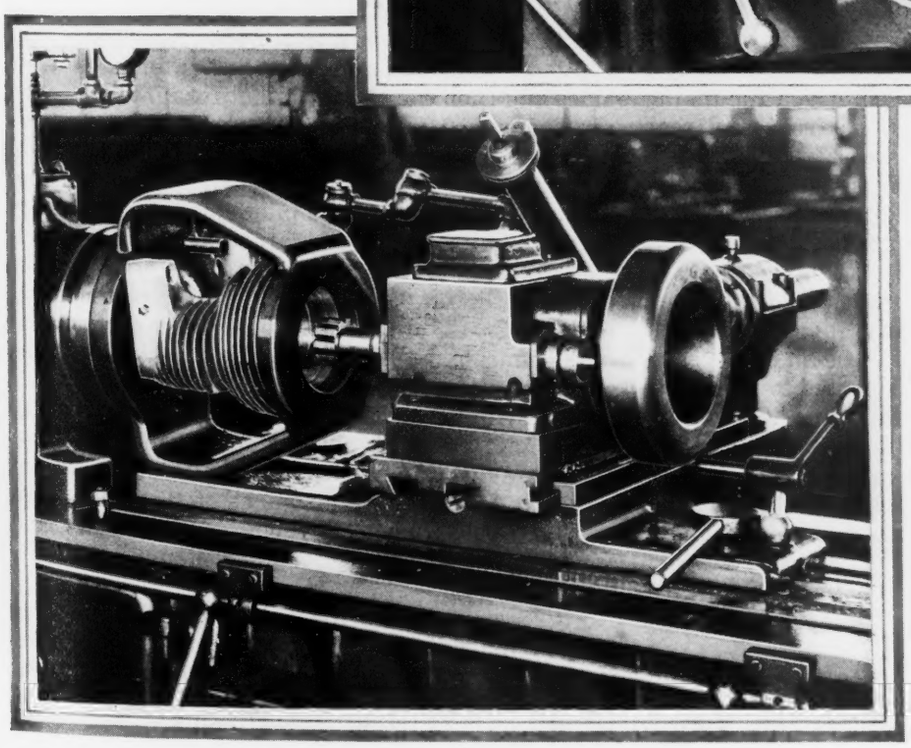


Fig. 12. A thread milling machine, as illustrated at the left, is used for cutting threads in the open end of the cylinder heads. The threads are of the United States standard form, 12 per inch on a 5-inch pitch diameter, and are cut to a length of 1 1/8 inches to receive the threads of the steel barrel on which the cylinder head is later screwed and shrunk, as indicated in the illustration Fig. 9. For the thread milling operation the work is rigidly held in a heavy chuck and is securely clamped by means of a pneumatic arrangement.

shaft, and the rear portion carries a roller bearing for the same part. The roller bearings are mounted in bronze liners, and the thrust bearing in a steel retainer.

The crankshaft is constructed of two heat-treated chrome-nickel steel forgings which are joined by clamping the crankpin of the front part into a ground hole in the cheek of the rear part. This double construction permits the use of a one-piece master rod with integral crankpin bearing, which gives greater strength, less weight, and longer life than can be obtained with a split rod bearing. The crankshaft parts are machined all over to insure accuracy, balance, and minumum weight, and to detect flaws. They are drilled to decrease the weight and to provide passages for delivering oil to the crankpin and link pin bearings. Counterweights are riveted to the crankshaft.

The master connecting-rod and the articulated rods are heat-treated chrome-vanadium steel forgings which are completely machined. Their blades are of H-section. The pistons are heat-treated aluminum alloy castings, of plain cylindrical type, with three grooves above and one groove below the piston-pin. The skirts are of unusual length in order to distribute the wear over a large area and to prevent "scuffing." All accessory drive gears are forged integral with chrome-vanadium steel shafts. With the exception of the helical pump gears, they are of the spur stub-tooth type. Pressure lubrication is supplied to the engine by means of a combination feed and scavenger oil-pump the driveshaft of which runs in ball bearings.

Work Handled on Vertical Turret Lathe and Horizontal Boring Machines

Standard machine tools are used throughout the aviation division to provide for any changes in manufacturing methods that may prove desirable and to meet the requirements in case other types of engines are brought out. The Bullard vertical turret lathe shown in Fig. 1 is employed for taking various cuts on such parts as the front and rear crankcase castings and the accessory case. The illustration shows an operation on the rear crankcase in which the rim is bored and faced, several pads are faced, and two holes are bored. The joint surfaces on the opposite side of this casting are also finished on the same machine.

After the two crankcase castings have been machined on the vertical turret lathe and have been assembled, the crankcase unit is passed to the Lucas boring machine shown in the heading illustration. This machine is equipped with a fixture that is indexed into seven different positions for machining the cylinder and intake holes, and into fourteen other positions for finishing the valve tappet guide holes. The operation involves the taking of a large number of cuts by means of ten tools which are arranged on the stand seen at the front of the machine.

Five of the tools are used successively on the fourteen valve tappet guide holes, and three on the seven intake holes, while roughing and finishing cutter-heads are employed on the cylinder holes for taking facing and boring cuts. A dial indicator, mounted on the boring arm, facilitates taking the different cuts to the proper depth. Approximately one crankcase is handled per hour in this machine.

Fig. 2 shows a Rockford drilling and boring machine employed for rough- and finish-boring four holes in the accessory case. A Rockford machine is also employed for rough- and finish-boring three crankshaft bearing holes in the crankcase.

Automatics Used for Machining Cylinder Heads and Barrels

Machining of the combustion chamber in the cylinder heads is performed in a Potter & Johnston automatic equipped as illustrated in Fig. 10. A similar machine, shown in Fig. 3, is used for boring and turning one end of the cylinder barrels.

Fig. 4 shows a Fay automatic employed for turning the fins on the exterior of the steel cylinder barrels after they have been rough- and finish-turned on a machine of the same type. In the machine illustrated, three sets of tools are provided. One set cuts the fins straight down to depth, a second set cuts them slightly tapered on one side, and a third set produces the taper on the opposite side. Each set of tools begins its operation after the preceding set has gained a lead of 0.010 inch, to prevent distortion of the fins. At the outside, the fins are about 3/64 inch thick and they are about 5/8 inch deep. There are sixteen fins on each barrel.

Another Fay automatic, as shown in Fig. 5, is used for taking turning and facing cuts on the crankshaft parts. In the immediate foreground, rear crankshaft pieces are shown standing upright on the floor, while directly in back of them, there is a pile of front parts.

Milling machines finish all the external surfaces of the connecting-rods. Both the master and articulated connecting-rods are first milled on their sides and then the channels that form the H-section are cut out on a Leland-Gifford machine arranged as shown in Figs. 6 and 11. The end-mill used in this operation is guided in the channels of the connecting-rod by means of a pilot along which a templet on the table is moved by turning the table handwheels. This type of machine is also employed for profiling the intake and exhaust pads of the manifold. Fig. 12 shows a Hanson-Whitney thread-milling machine engaged in cutting threads in the open end of a cylinder head.

The cylinder-barrel bores, the hole in the rear crankshaft part, the master connecting-rod holes, and the articulated rod holes are ground in Heald "Size-Matic" grinding machines of the type shown in Fig. 7. All piston-pin holes of the master and articulated rods are later bushed and diamond-bored.

Fig. 8 shows a Norton grinding machine which is used for finishing the crankshaft pieces. The Hoskins electric furnace illustrated in Fig. 9 is used for heating the cylinder heads preparatory to shrinking them on the steel barrels.

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

EXPANDING MANDREL FOR LOCOMOTIVE CYLINDER BUSHINGS

By J. H. HAHN

In large locomotive repair shops, it is considered good policy, from the standpoint of economical operation and maintenance, to carry in stock one or two semi-finished cylinder bushings for each of the various types of locomotives. These semi-finished bushings are machined to standard dimensions on the inside, faced to length, and left over-size on the outside. When an engine is sent to the shop in need of a cylinder bushing, one of the semi-finished bushings can be placed on the mandrel shown in the accompanying illustration and quickly turned to fit the cylinder.

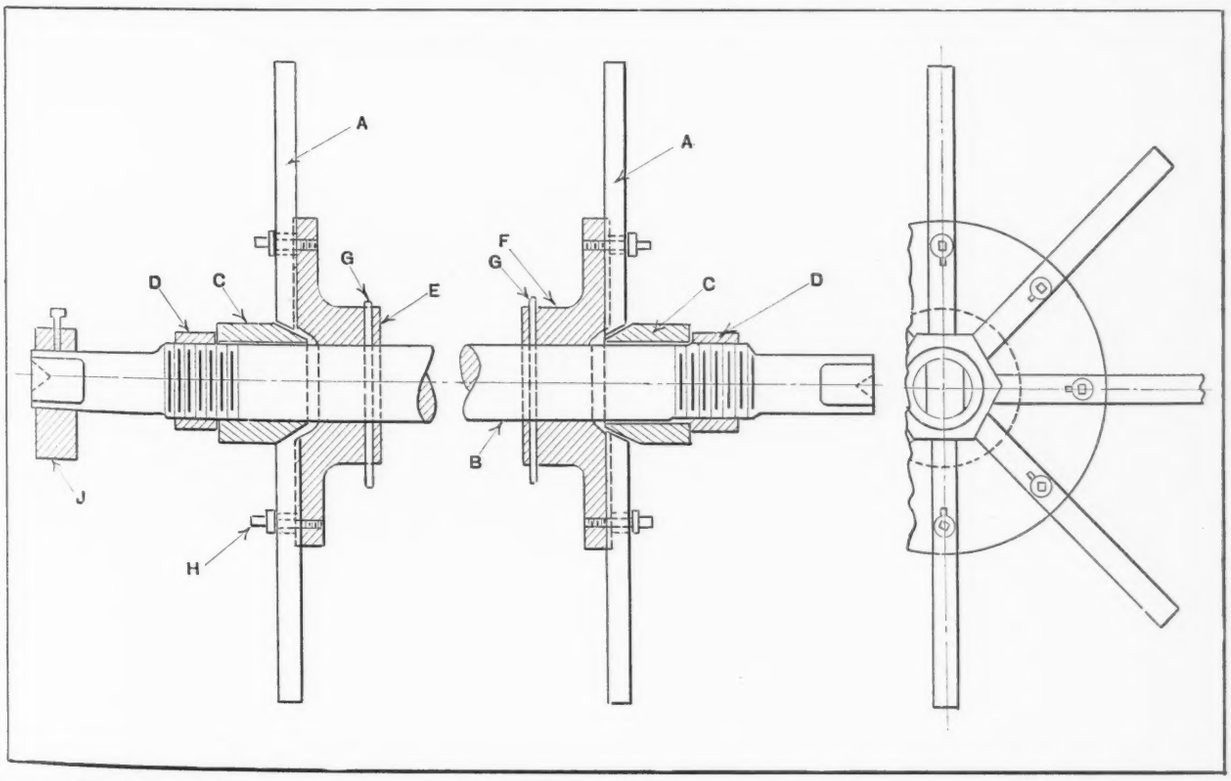
The steam ports are also milled and the job completed in much less time than would be required if the bushing were machined from a rough casting. The mandrel shown will accommodate bushings ranging from 19 to 39 inches in diameter of the type used for the low pressure cylinders of mallet articulated compound locomotives.

By referring to the illustration, it will be noted that the mandrel consists of a shaft *B*, two spiders *E* and *F*, two cone washers *C*, two nuts *D*, and sixteen arms *A*. Bushings of different sizes are accommodated by using interchangeable arms of different lengths. A special wrench is used to tighten the nuts *D*. The bushing to be machined is pressed on the mandrel, which is adjusted to suit the diameter of the bushing.

In assembling the mandrel, the spiders are pressed on the shaft *B* and drilled and reamed for the tapered pins *G*. As it is unnecessary to make any adjustment in the spacing of the spiders, they can be pinned to the shaft. The ends of the arms *A* are machined to the same angle as the conical ends of the washers *C*. When the nuts *D* are tightened, the conical ends of the washers will expand or force the arms *A* outward so that they will grip the bushing.

The arms fit into slots milled in the faces of the spiders and are held in position by 5/8-inch cap-screws *H*. Elongated holes are provided in the arms for the cap-screws in order to allow for sufficient adjustment or expansion. The dog shown at *J*, which is used to drive the mandrel, is machined with an oblong slot which fits over the flattened end of the mandrel. The same type of mandrel constructed on a smaller scale can be used for the various kinds of bushings required in repairing locomotives.

Mandrels like the one shown in the illustration can be made in the average railroad repair shop at a low cost, as no special castings or forgings are re-



Mandrel with Interchangeable Expanding Arms for Holding Locomotive Cylinder Bushings of Different Sizes

quired. The shaft *B* of the mandrel shown is 4 1/2 inches in diameter, the spiders 20 inches in diameter, and the arms *A* 16 7/8 inches long by 1 19/32 inches square.

SALVAGING SCRAP IN A RAILROAD SHOP

By A. EYLES

In the large railroad sheet-metal shop where the writer is employed, comparatively expensive metals such as aluminum, brass, copper, duralumin, monel metal, tin, and zinc are used more extensively than the less costly steel and galvanized iron sheets. The shop is engaged in both production and repair work, and these two facts complicate the matter of scrap salvage.

Important savings in scrap are effected in the power press department by using up scrap pieces of fairly large area for the production of small stampings. This involves increased handling time due to the greater difficulty of handling scrap pieces as compared with standard sheets. However, because of the saving in cost, pieces of scrap material are used up in this manner as soon as possible.

Small pieces of non-ferrous scrap are collected and deposited in steel bins which are fitted with locks. These bins are emptied weekly, the scrap being taken to the store-room which credits the department from which the material is received. A form filled out by the store-room clerk gives a description of the scrap, its quantity, and price.

Iron and steel sheet scrap coming from the power presses is baled by an automatic machine. The bales weigh from 150 to 200 pounds, being about 14 inches square and from 6 to 12 inches thick. On an average, one ton of sheet-steel scrap can be baled per hour by one man.

By baling the scrap, the carrying capacity of the freight cars in which it is shipped is increased, since bulk and not weight is the governing factor. In addition, a higher price can be obtained for baled scrap than for loosely bundled material.

A large amount of scrap metal is obtained from water tanks; signal, locomotive, and passenger lamps; buckets; and oil-cans that are beyond repair. These parts often consist of two or more metals, such as brass, copper, and tin plate, and have riveted and soldered joints. When sufficient scrap of this class has accumulated, it is heated in an open furnace to a temperature somewhat higher than the melting point of solder. The solder drips through the grate bars into a pan which is transferred to a refining furnace. Here the solder is remelted in a pot, and the dross is skimmed off to leave the solder pure enough to be cast into bars or strips.

The pieces of scrap material from which the solder is melted are taken from the open furnace, and after cooling, all brass and copper parts are removed from the tin plate. Each kind of scrap is put into separate bins.

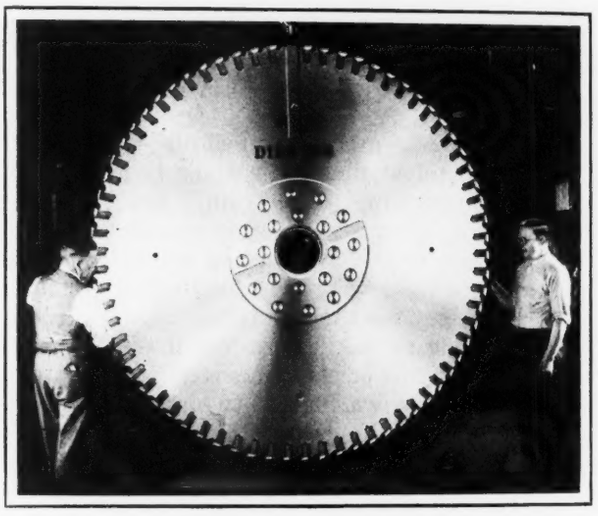
Articles consisting solely of tin- or terne-plate or tinned steel, having soldered joints, are also treated in the manner described to reclaim the solder. Considerable care is taken to see that no scrap zinc or zinc-coated articles, such as galvanized iron or steel, become mixed with the scrap tin plate or tinned steel articles, because zinc has an injurious effect on soft solder.

Galvanized scrap is heated separately in a furnace to a temperature exceeding the melting point of zinc, and held at that temperature until the zinc has completely melted off the iron or steel surfaces.

* * *

GIANT METAL-CUTTING SAW

What is said to be the world's largest metal-cutting saw has just been completed by Henry Disston & Sons, Inc., Philadelphia, Pa., for the Midvale Co., of Philadelphia. The saw, which measures 110 inches in diameter and is 15/16 inch thick, will be used in cutting large steel forgings. The finished saw weighs approximately 1 1/2 tons. The Disston Works have made several wood saws measuring 110 inches in diameter, but this is the first metal-cutting saw of this size.

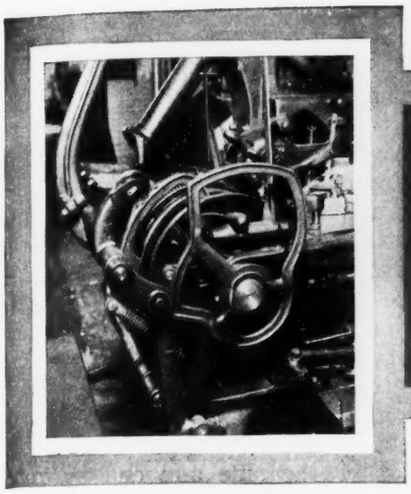


A 110-inch Diameter Disston Saw for Cutting Large Steel Forgings

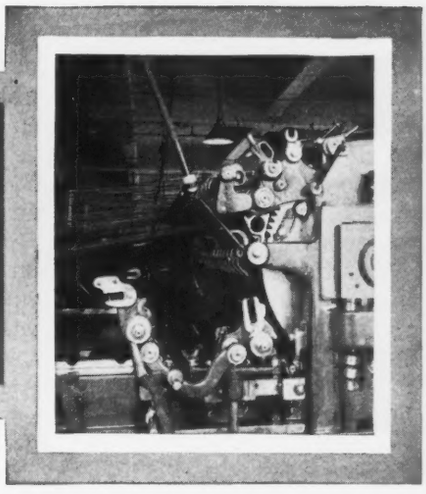
The plate from which the saw body was made weighed nearly 3000 pounds; after machining and milling, it weighed about 2500 pounds, and with the teeth inserted, 3100 pounds. The saw is constructed with the Disston type of interlocked teeth. The teeth are adjustable so that they can be moved out as they wear down. They weigh more than 2 pounds each. The saw is driven by keyways cut into the flanges, as shown in the illustration. These flanges are 35 inches in diameter and 2 inches thick.

* * *

Motor coach engine governors are considered in some cases to be more of a menace than a safety device, according to an article in the *Journal* of the Society of Automotive Engineers. In cases where an attempt is made to pass another car on the road and the driver increases the speed, a collision may occur if the governor shuts off the power.



Ingenious Mechanical Movements



AUTOMATIC OVERLOAD TRIP FOR BELT AND CHAIN DRIVES

By W. J. GIBBS

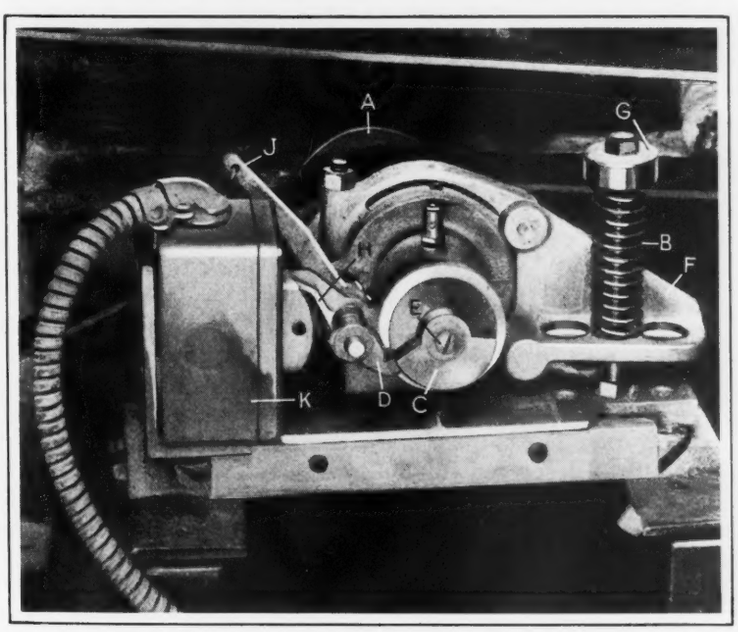
Certain classes of machines and other types of mechanical apparatus require automatic protection against overloads such as are likely to be caused by some abnormal operating condition. Automatic machines, for example, may jam at times because of some disarrangement or defect related to one of the parts, packages, or other units that the machine is operating upon. When troubles of this kind occur, automatic and instantaneous protection may be necessary to prevent damage to a costly machine and expensive delays for repairs. The automatic overload trip to be described has proved to be reliable, quick-acting, and precise in its control when adjusted for a given load.

The illustration shows this overload protector applied to a belt drive, but it is equally adapted to chain transmissions. The tight or driving side of the belt passes over idler pulley *A*, which is eccentrically mounted. If the tension on the belt is increased beyond normal, due to an excessive load, the eccentric mounting of pulley *A* rotates against the resistance of spring *B*, which has previously been adjusted to suit the limit of power to be transmitted. If the eccentric movement of pulley *A* continues beyond a certain point, cam *C* will release trip-shoe *D* and open the motor control switch.

Pulley *A* is mounted on a stud shaft eccentrically attached to spindle *E*. The spring arm *F* is also attached to spindle *E*, and nut *G* is used for obtaining the required spring tension. This spindle assembly, with its trip-cam *C*, is mounted in ball bearings to insure sensitiveness. The tripping mechanism consists, in addition to cam *C* and shoe *D*, of a switch trigger *H* and reset lever *J*, to the outer end of which is attached a spring. The electric switch operated by trigger *H* is enclosed in casing *K*. An excessive load tends, of course, to straighten the driving belt, which, in turn, tends to shift the eccentric against the action of spring *B*, the size and adjustment of which depend upon the load requirement.

The operating characteristics of a machine can be compensated for by the amount of travel of cam *C* relative to trip-shoe *D* before disengagement. In the particular installation shown, this adjustment or overlap prevents tripping due to the effect of a belt splice. The overlap of *D* on *C* may also serve to provide for small peak loads. In resetting the tripping mechanism, lever *J* is raised against the tension of its spring until trip-shoe *D* clears cam *C*, when the latter, with the eccentric shaft and pulley, are forced around by spring *B* so that shoe *D* rests upon the cam. When trigger *H* is thus raised to its normal position, the switch in casing *K* may be reset. This resetting of the trip mechanism after its release, requires only a few seconds.

The protector shown in the illustration is applied to an automatic wrapping machine. This machine runs rap-



Automatic Overload Trip for Protecting Machinery against Excessive Loads and Resulting Damage due to Abnormal Operating Conditions

idly, and if a faulty package should cause a jam, the feeder arms, unless protected by an overload trip, would either break or the machine would be strained so as to require considerable readjustment. With this tripping device, even relatively slight overloads cause the power to be cut off. Service can be re-established in from one to three minutes, this being the time needed to remove the defective package and reset the device.

Another important application is in connection with restaurant conveying machinery. In loading a vertical conveyer, careless attendants often drop dishes, silverware, towels, etc., so that they jam, and before the fuses of relays function, serious damage is likely to result. Moreover, if fuses blow too often, others may be installed which have larger capacities, thus increasing the likelihood of damage. In order to demonstrate the instantaneous action of the overload protector for conveyor service, an aluminum tray may be jammed in the conveyer, with the result that the machine is stopped without damage either to the tray or to the conveyor mechanism.

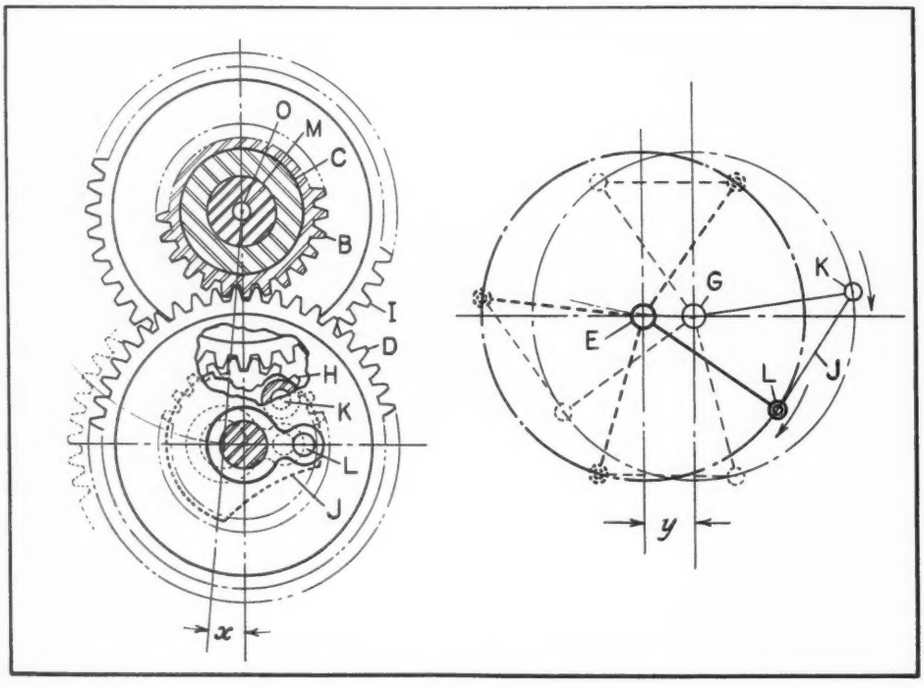


Fig. 1. Diagrams Used to Illustrate Operation of Velocity-changing Mechanism

* * *

VELOCITY-CHANGING MECHANISM

A mechanism for imparting an oval or elliptical rotary movement to the work-holding block of a hat-finishing machine was described in August MACHINERY, page 920. The rotary mechanism and the velocity-changing mechanism described in this article are both incorporated in a hat-finishing machine made by Doran Bros., Danbury, Conn.

As explained in the previous article, the finishing of the hat is done by a pad faced with sandpaper. This pad automatically travels from the top or center of the hat to the band while the hat is being revolved. An automatically controlled oscillating movement is also imparted to the finishing pad. The oval rotary motion mechanism referred to is required in order to keep the work in proper contact with the finishing pad.

Now, in order to finish the hat evenly all over, it is necessary to vary the angular velocity of the chuck on which the hat is mounted. If the spindle were revolved at a uniform speed, the front and back portions of the crown would be over-finished and the sides under-finished as a result of the difference in surface speed caused by the oval shape of the work. It is the purpose of the mechanism shown in Fig. 2 to increase the speed of rotation of the spindle as the front and back surfaces pass under the finishing pad.

As the oval head revolves, the quarters between the side and end portions must lift the working pad 3/4 inch in one-quarter revolution, thus increasing the pressure on the pad. As it passes from the end portion to the lower side, the pad drops 3/4 inch in one-quarter revolution, and this falling action gives less pressure on that portion. The oval head mechanism so acts that all portions of the section of the body with which the pad is in contact are raised to the same plane.

The same oval shape condition makes necessary the use of the differential angular velocity mechanism. The curvature of the end portions is sharper and the contact area of the pad on the hat is, therefore, less on these portions and the intensity of pressure greater. The side portions, being flatter, are subjected to less pressure by the pad. This condition would result in cutting the ends faster than the sides if the differential angular mechanism did not move the ends more quickly under the pad, the change in velocity being adjustable to suit the shape of hat.

The block that carries the hat is revolved by the spindle *C*. By means of the control lever *S*, the spindle *C* can be connected directly with the driving pulley *A* so that it will run at the same speed, which might be required in finishing the band of a cylindrical or perfectly round hat. By moving the control rod *S* in the opposite direction, the variable velocity mechanism is brought into action. This mechanism causes spindle *C* to make one complete revolution to every four revolutions of the driving pulley *A*.

By means of the velocity-changing mechanism, the angular velocity of spindle *C* can be increased and decreased twice during one complete revolution. This change in velocity is synchronized with

the oval motion mechanism, so that a uniform finishing effect is obtained. The amount of variation in the velocity is controlled by the rod *R* which is actuated by the same cam that controls the oval motion mechanism.

The operation of the mechanism may be described by following the drive through from the pulley *A* to the spindle *C*. Passing through a slot face of the pinion *B*. The spindle *C*, through this contact, is driven at the same speed and in the same direction as the pinion *B* and its driving pulley *A*. When operating in this manner, the gear *D*, pinion *H*, and gear *I* all rotate on their free bearings and do not have any effect on spindle *C*.

When the push-rod *M* is pulled forward by rod *S*, the clutch finger *N* is disengaged from pinion *B* and

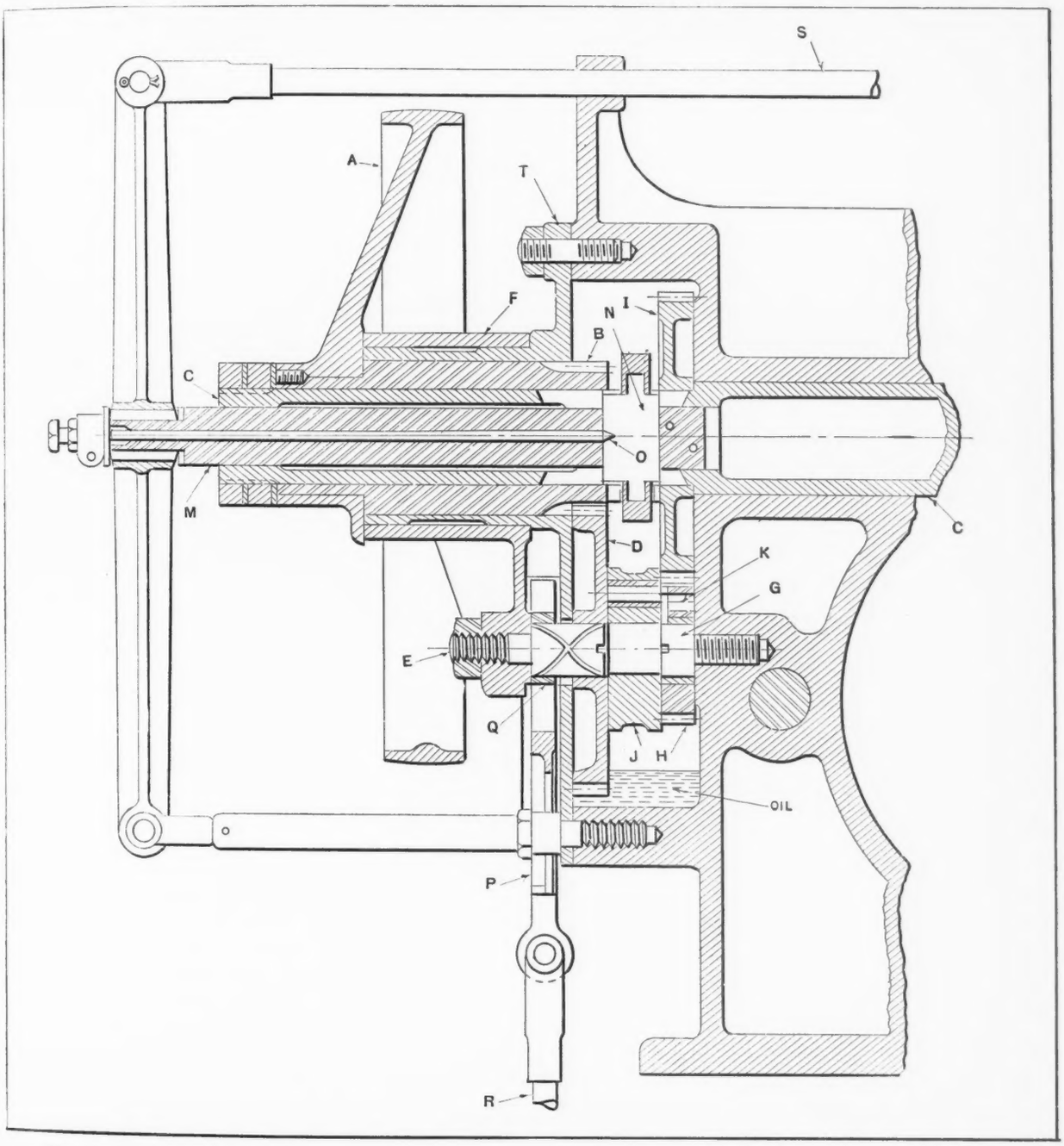


Fig. 2. Mechanism which Increases and Decreases Angular Velocity of a Shaft Twice During Each Revolution

or opening in the push-rod *M* is a clutch finger *N* which is securely locked in the push-rod by the pointed rod *O*. Corresponding with the clutch finger opening in the push-rod are similar openings in the spindle *C* through which the clutch finger *N* freely passes.

When the push-rod *M* is moved backward by the control rod *S*, the clutch finger *N* engages the clutch engages the clutch face of gear *I* which then drives the shaft *C*. The drive is now transmitted through the pinion *B* to gear *D*, through link *J* to pinion *H* and thence to gear *I* at a reduction in speed of four to one as compared with the direct drive from the pulley *A*.

The gear *D* is mounted on the stud *E* secured to the sleeve member *F*, which can be swung about the

hub bearing on the cover plate *T*. When the stud *E* is in axial alignment with stud *G*, gears *H* and *D* have the same speed and this speed is constant. The slide *P* has an angular slot in it which fits over the slide shoe *Q* on stud *E* and serves to move stud *E* of gear *D* out of alignment with the stud *G* in accordance with the movement imparted to rod *R* by the cam that also controls the oval mechanism.

In Fig. 1, angle x and dimension y indicate the amount of "out of line" adjustment between the studs *E* and *G*. This adjustment is varied automatically from zero, when the finishing pad is at the top or center of the hat crown, to the maximum amount, when the finishing pad reaches the band of the hat. It is this changing of the axial relation of gear *D* and pinion *H* that controls the differential velocity. The diagram to the right in Fig. 1 will help make clear how the changing of the relative angular positions of the studs *L* and *K* and their connecting link *J* produces a variation in the velocity of the driven pinion *H*.

The change in angular velocity occurs once in each revolution of pinion *H*, but since pinion *H* makes two revolutions for each one of driven gear *I*, the change in the angular velocity of the latter gear and its spindle *C* occurs twice during each revolution. By changing the linkage connections between the rod *R*, Fig. 2, and the cam by which it is actuated, it is possible to control the amount of variation in angular velocity.

It will be noted that the same reference letters are used in both Figs. 1 and 2 to indicate the same parts. A segmental circular opening is provided in the lower portion of the cover plate *T*, Fig. 2, to allow sleeve *F* to swing on its hub bearing. The link *J* has no center bearing, and is held in position by the two drive pins *K* and *L*. The pin *L* projects from the inner face of gear *D* into a hole in link *J*. The pin *K* is made eccentric for convenience in assembling, but it would be possible to use a straight pin, as far as the operation of the mechanism is concerned.

The Use of Trade Journals in Vocational Schools

By FRANK C. GORDON, Wilbur Wright School, Detroit, Mich.

There is much discussion on how to use trade journals in classroom work in vocational schools, but little has been published on the actual methods whereby the best results may be obtained. Not only are the reading pages of value to the alert boy in a vocational school, but the advertisements in trade journals are of considerable interest to him as well.

Trade journals are the best sources of information on present-day developments. Books are soon out of date on many kinds of topics. It is a good plan for the boy to discuss with his friends what he reads in a trade journal, as this adds interest to the reading and stimulates him to try to retain the more important information.

The boy, however, must be guided in reading trade journals. After having selected a journal that he wants to read, he must choose the particular articles that he wants to study carefully. It is unwise, as a rule, to read all that the magazine contains, just as it would be to read everything in a newspaper.

In reading a magazine, then, the boy should first make a selection of the article that he wants to read by looking at the table of contents and then glancing over the articles that seem to fit his needs and interests. It is fairly easy to select those articles that seem most worth while. By skipping those of less importance, the boy saves time and can read the remaining articles to better advantage. Sometimes he may only need to read certain parts of an article that are of particular value and interest to him.

In one vocational school, each boy is required to make a list of the trade journals that he reads. Then he is asked to state which journals seem most suited to apprentices and students of vocational schools and give the reasons why. Next he is requested to read a trade magazine according to the suggestions given in the preceding paragraphs of this article and to report in class what he has read. He has to answer the questions "What did you omit and why?" and "How did you find out what to omit?" He is further asked to acquaint himself with the names of the best writers in the trade journals and to make a list of the five whom he especially likes.

The boys are encouraged to examine carefully as many trade journals as they can obtain for that purpose. When they have access to a public library, they generally have an opportunity to examine a complete list. School and factory libraries also provide, as a rule, a good selection. At regular intervals, the boys report in class on the magazines that they have examined and refer to articles that seemed of especial value in the trade for which they are fitting themselves.

Trade journals may also be used to advantage in the classes in English in vocational schools. The following method has been used successfully for this purpose: The boy selects a magazine and an article that particularly interests him. He prepares a report on the subject for class discussion. Unfamiliar technical terms are looked up in an engineering handbook. After the boy has given his report, the instructor comments on the material selected, the way in which the report was presented, and the English used in the presentation.

MILLING ROUND-END KEYWAYS IN SHAFTS

The milling of keyways of the round-end type, especially in large shafts, has always been a rather difficult job. The set-ups for this kind of work are generally of a temporary nature, and are not only time-consuming but also tend to produce inaccuracies near the ends of the keyways. A method now in operation in the plant of a large company building cranes, rolling mills, and other large machinery has proved very satisfactory. A Cincinnati plain Hydromatic milling machine, built by the Cincinnati Milling Machine Co., Cincinnati, Ohio, is used for this purpose.

On this machine, a special vertical-spindle carrier is employed in conjunction with the regular horizontal spindle, as shown in the illustration. The regular over-arm is replaced by a special heavy over-arm held in the V-bearings at the top of the horizontal-spindle carrier. The vertical-spindle carrier is mounted on this over-arm and is driven through a special drive from the horizontal spindle. The vertical spindle, which has a flange end made in accordance with the National Standard, revolves in a heat-treated steel quill, 6 1/2 inches in diameter, with double mounting of anti-friction bearings, both at the front and at the rear. There is a 5-inch adjustment of the quill.

Eight changes of speed ranging from 82 to 620 revolutions per minute for the vertical spindle, and eight changes ranging from 17 to 127 revolutions per minute for the horizontal spindle are available through pick-off gears. Horizontal adjustment of the vertical carrier along the over-arm is obtained by the use of a handwheel located at the front of the over-arm. Cam levers are provided for clamping the quill quickly in the vertical carrier and the carrier to the over-arm.

An important feature is the provision made for easily lowering the slotting cutter on the horizontal arbor into the cut and raising it again. This is done by using a hydraulic counterweight on the horizontal-spindle carrier. At the front side of the machine bed is located a large handwheel with dial for making vertical adjustments of this carrier. Adjustment can also be made just below the horizontal carrier by a hand-crank.

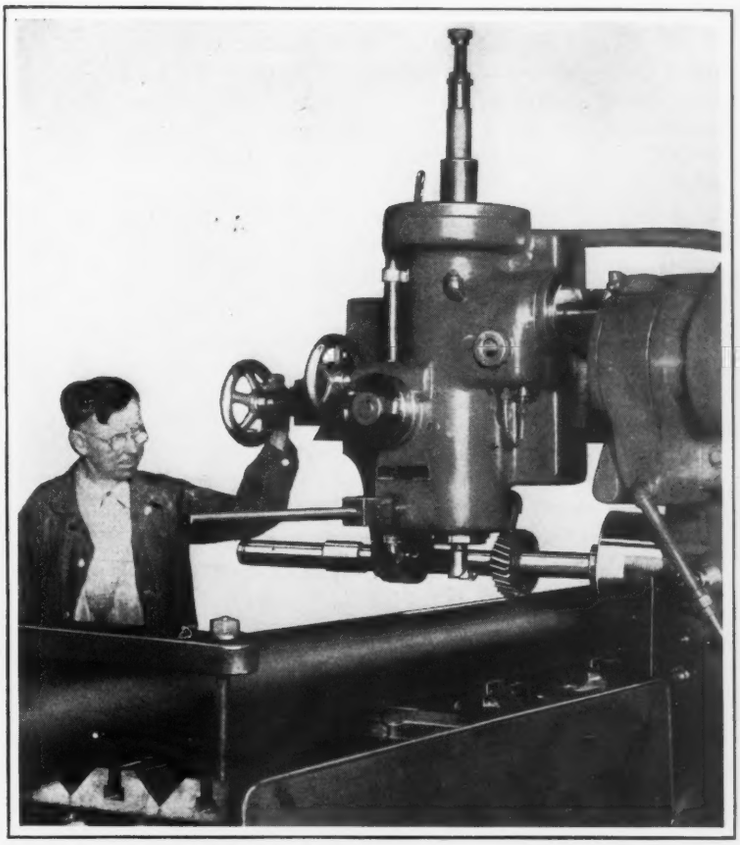
This particular set-up shows a large steel shaft in which a keyway is being milled. The shaft is clamped in V-blocks by straps. An alternate-tooth slotting cutter, 6 inches in diameter, running at 40 revolutions per minute, with a table feed of 4 inches per minute, is used for milling the straight portion of the keyway, which is 18 inches long, 1 1/2 inches wide, and 25/32 inch deep.

After the straight portion is milled, the cutter is raised from the cut and a 1 1/2-inch fishtail end-mill in the vertical spindle is lowered into the keyway for rounding out the ends. A positive stop on this spindle permits the milling of duplicate work to close limits. For this operation, a spindle speed of 265 revolutions per minute and a table feed of 2 inches per minute are used. A feature of this machine for work of this type is the two-way reciprocating cycle, permitting feed and rapid traverse in both directions. There is a stop lever at each end of the bed for starting or stopping the table during the cut without affecting the cycle of operation.

* * *

EXPORTS TO SOVIET UNION INCREASE

According to information obtained from the Amtorg Trading Corporation, 261 Fifth Ave., New York City, this corporation placed orders during 1929 for shipment to the Soviet Union aggregating $94,500,000, nearly three times the purchases for 1928, which totalled $32,300,000. The total Soviet American trade for 1929 is estimated at $155,000,000, as compared with $101,000,000 in 1928. The large expansion in the business of the Amtorg Trading Corporation, it is stated, was due to the greatly increased demand in the Soviet Union for modern machine equipment to be used in new industrial enterprises and for agricultural machinery for the large state and cooperative farms. Purchases of industrial and electrical equipment in 1929 rose to $40,000,000, and orders for agricultural machinery and equipment, to $34,500,000. Automotive equipment reached a value of $8,750,000. About eight hundred American business men and engineers visited the Soviet Union last year.



Milling Round-end Keyways, Using an Auxiliary Vertical Head

Practical Points on Doweling Methods

Designers Must Pay Attention to the Location and Arrangement of Dowels to Insure Accuracy and Facilitate Assembling

By JACOB H. SMIT

TO make dowel-holes that are accurately located and that fit the dowels properly requires time and skill. Drilling and reaming is not always a satisfactory method of producing dowel-holes in jigs when the work must be held within close limits of accuracy. In one case, where a number of interchangeable milling fixtures were required to have four dowel-pins each, the limits of accuracy on the spacing between the dowels was 0.0002 inch. A hardened and ground plate about 1/2 inch thick was used as a jig for locating the dowel holes in this work.

Slip bushings were made for a centering tool and for a drill and a reamer. All holes and tools were ground and lapped to a close fit. When in use, the plate was clamped on one of the fixture bars and the holes drilled. Some of the workmen could locate the holes within 0.00025 or 0.001 inch of the exact dimension, while others could not get the holes closer than 0.002 inch by this method.

If the holes were off center, they were corrected by hand-scraping. Possibly too great a feeding pressure on the tools affected the accuracy in some cases. When too much pressure is used, the tools are likely to be forced out of alignment and will not be given sufficient time to cut the metal along the path that the cutting point or edge would normally follow.

Using a Master Plate for Duplicate Doweling

For duplicate doweling, when close limits of accuracy are required, that is, when the work must be held within limits of 0.001 inch, the safest plan is to use a master plate, provided the piece to be doweled can be swung on a lathe and the cost is not prohibitive with this method. Many toolmakers rely on this method of securing the desired accuracy.

The procedure is as follows: Holes having the required spacing are first made in a hardened plate, or a soft plate is made with hardened bushings having the proper spacing. The bushings are made interchangeable in this case. The master plate is then clamped or doweled to the work in which the dowel-holes are to be produced. A plug is fitted into the tapered center hole of the lathe spindle and the protruding end turned, ground, or lapped to a close fit in the holes in the master plate.

By simply fitting one of the holes in the master plate on the plug projecting from the lathe center, the corresponding hole in the work, which is secured to the master plate, can be drilled and bored. The remaining holes are located, drilled, and bored in the same manner, relocating the work for each hole. Close duplication can be obtained by this method, provided the lathe spindle is in good condition and the work is fairly well balanced.

Fitting Dowels to Facilitate Assembling and Disassembling

Observations made by the writer while machining and assembling more than thirty automatic machines of different designs have led to the conclusion that doweling is not given the attention it deserves by designers and draftsmen. A tool or machine should be so built that it can be taken apart without the use of a sledge hammer and without marring the paint.

Unless the doweled part is to be subjected to a great strain, it is good practice, ordinarily, to make the dowels a drive fit in the top member and a slip fit in the matching part. Often the dowel-pins are made longer than the service requires. This condition results in a slowing up of repair work.

If there is space enough at the back to permit the dowels to be easily driven out, it does not matter whether the dowels are a tight fit in the front or the back member. When they are tight in the front part, however, the weight of the part, resting on the dowels, may have a tendency to bend the dowel-pins if they are left soft. To avoid trouble of this kind, the dowels should be driven out of the work before the fastening screws are loosened.

The amount that a dowel-pin projects can be equal to its own diameter plus 1/8 inch. The dowels used on strippers or guide plates for ordinary die work should be so fitted that the parts can be disassembled without undue forcing or prying. Taper pins can often be used to advantage for machine building where the parts to be doweled are left soft. The original dowel-holes can be drilled in a jig if desired, and after being correctly located, the parts can be taper-reamed.

If the pins cannot be driven out from the back, the holes in the back part should be slightly enlarged, so that when the taper pin is driven tightly into the front part, it will be a good fit in the rear part but still be loose enough to permit removing the front member.

Using Dowels for Special Machine Work

On special or automatic machine work when an electric drill must be used to produce the dowel-holes, it is best to leave enough stock in the holes to permit accurate reaming. For pins over 5/16 inch in diameter, 1/32 inch of stock should be allowed in the holes for the reaming operation. This is desirable, as failure to keep the drill properly aligned will cause the holes to be enlarged at the

mouth. It is good practice o use an under-size reamer first and finish the dowel-hole with another machine- or hand-reamer which cuts accurately to size.

When a hole is to be drilled at the bottom of a larger hole and it is necessary that the two holes be concentric, the best results will be obtained by using a hardened bushing which fits into the larger hole. Such a bushing will have a thin wall, but the part that projects above the hole should be made thicker to provide a good grip for the hand. The use of taper pins in hardened work is not advisable, as the hardening of the pieces often causes the dowel-holes to become curved at the center, and it is a costly and tiresome job to lap a tapered dowel-hole in a hardened piece.

The dowel-holes in a piece should all be the same size. Using dowels of different sizes on the same piece is a source of much trouble. On die work especially, the dowels are often removed and if one of the dowels is 0.001 or 0.002 inch larger than the other, there is danger of scoring the dowel-holes should the dowels become mixed.

In the case of molds for die-castings and for Bakelite or Condensite products, where the parts are subjected to heat, more clearance should be given the sliding parts of dowel-pins and any movable part which becomes hot. Pins or parts for use under such conditions should be hardened on their sliding surfaces, and they should be drawn to a blue color in order to give them the desired toughness. If left too hard, they may snap off when the mold becomes jammed through running too long a time without proper lubrication. The clearance in the dowel-holes should be about 0.003 or 0.004 inch. This amount of clearance is particularly necessary where four long pins are used as guides, to allow for the unequal expansion of the molds and any unevenness in the dowels that may result from hardening.

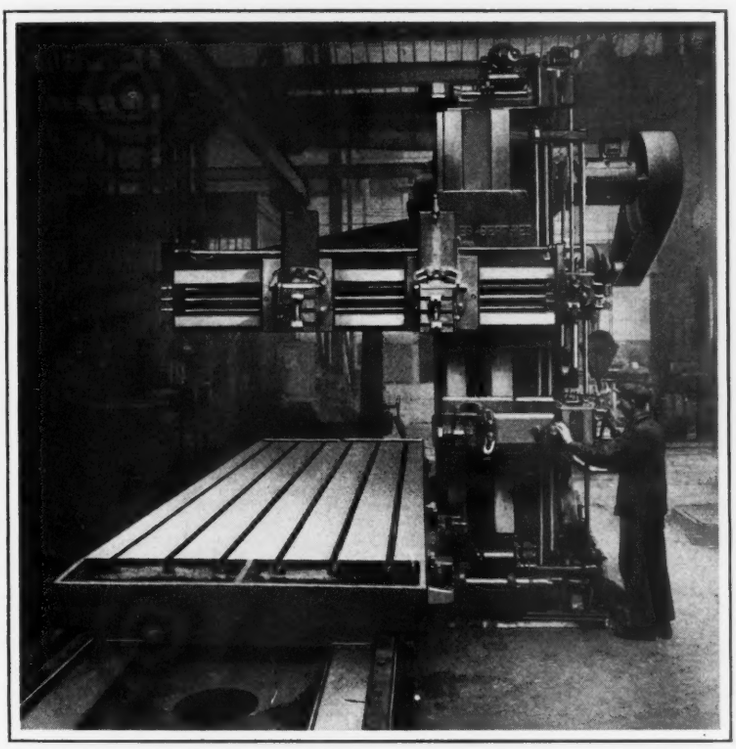
* * *

Nearly 4,000,000 people are directly or indirectly employed in the automobile transportation business, including those employed in factories building automobiles and trucks.

PLANER WITH MECHANICAL HIGH RETURN SPEED

Cutting speeds of 30, 50, and 100 feet per minute and a return speed of 200 feet per minute are obtained mechanically without the use of a variable-speed or reversible motor, in the single-upright planer shown in the accompanying illustration. This machine is a development of the Etablissements Charles Berthiez, 44, Rue Lafayette, Paris, France. When the machine is motor-driven, one motor supplies the power required for the return stroke of the table. Power for the cutting stroke is furnished by an additional motor, coupled to the machine during the cutting stroke only.

On a belt-driven machine, power for the cutting stroke of the table is obtained through a pulley that is independent of the drive to the table for the return movements. This pulley is made to receive a wide belt, since the belt is never shifted. As in the case of the motor that provides power to the motor-driven machine for the cutting stroke of the table, this pulley is coupled to the machine during the cutting stroke only.



Planer Operated at High Cutting and Return Speeds without Reversing the Drive

The particular planer illustrated accommodates work up to 80 inches wide and 60 inches high. The length of stroke is 13 feet. Planers have been built by this concern with return table speeds up to 300 feet per minute obtained mechanically.

* * *

GRAY IRON INSTITUTE MEETINGS

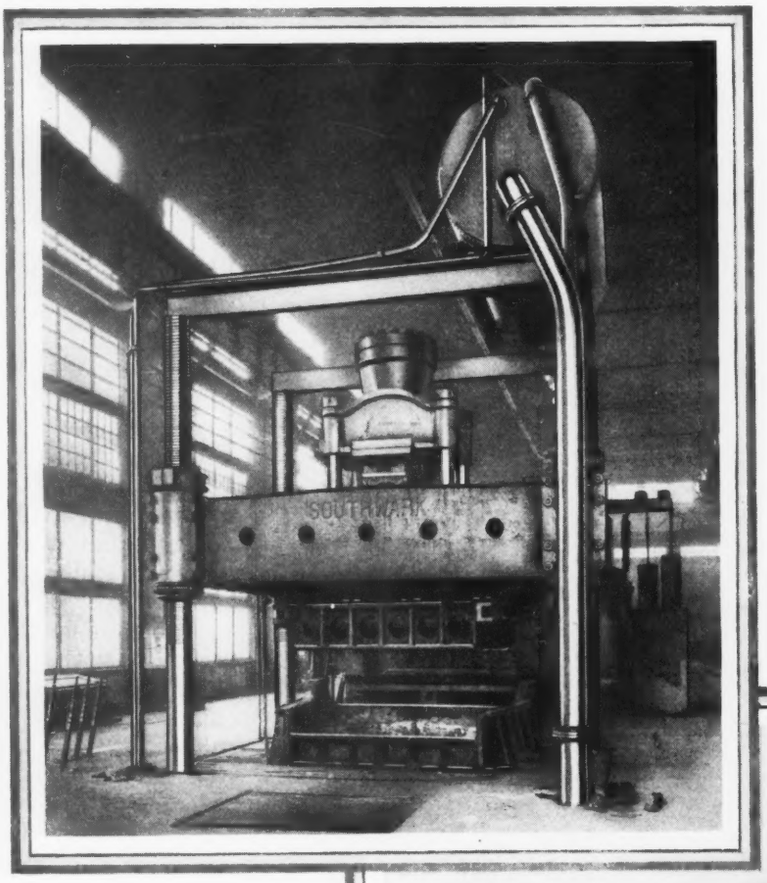
In carrying out its policy of assisting members in the different territories to form local chapters of the Gray Iron Institute, which has headquarters in the Terminal Tower Building, Cleveland, Ohio, the Institute held a series of meetings during February in Buffalo and Syracuse, N. Y.; Harrisburg and Philadelphia, Pa.; and Baltimore, Md. Every gray iron foundry executive in the respective districts was invited to attend the meetings. Four of a series of eight meetings had also been previously held in the Western territory. Arthur J. Tuscany, manager of the Institute, states that the meetings thus far held have more than justified the expectations of those who planned them.

Notes and Comment on Engineering Topics

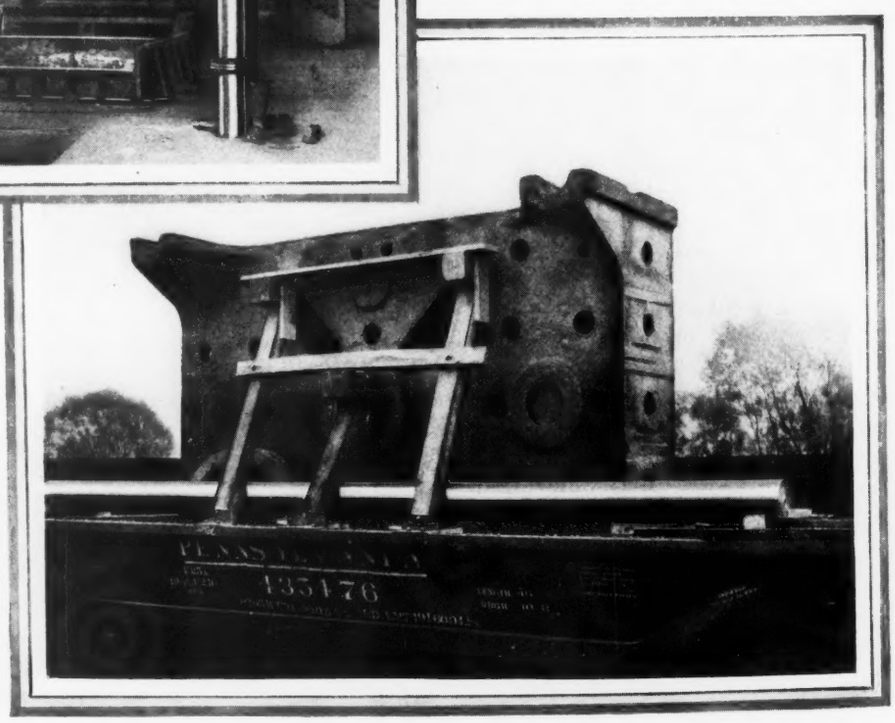
In London there are over 5000 motor omnibuses in daily service, carrying annually more than 1,250,000,000 passengers.

The longest direct air line in the world operating between Chicago and San Francisco is now equipped with twelve eighteen-passenger tri-motored airplanes, which carry mail and passengers between these points in twenty hours.

As a result of numerous wind-tunnel tests of automobile fans, it was found, according to an article in the *Journal* of the Society of Automotive Engineers, that a two-blade fan delivers about one-half as much air as an eight-blade fan. It was also proved that with a blade angle of about 30 degrees and fewer blades, the greatest efficiency and quietest running could be obtained. Furthermore, flat blades were found to run more quietly than the curved type.



A 1400-ton Flanging Press Built by the Southwark Foundry & Machine Co. for the Baldwin Locomotive Works, Eddystone, Pa.



Platen Casting and One of the Rough-turned Columns of the 1400-ton Flanging Press, Loaded on Railroad Car for Shipment

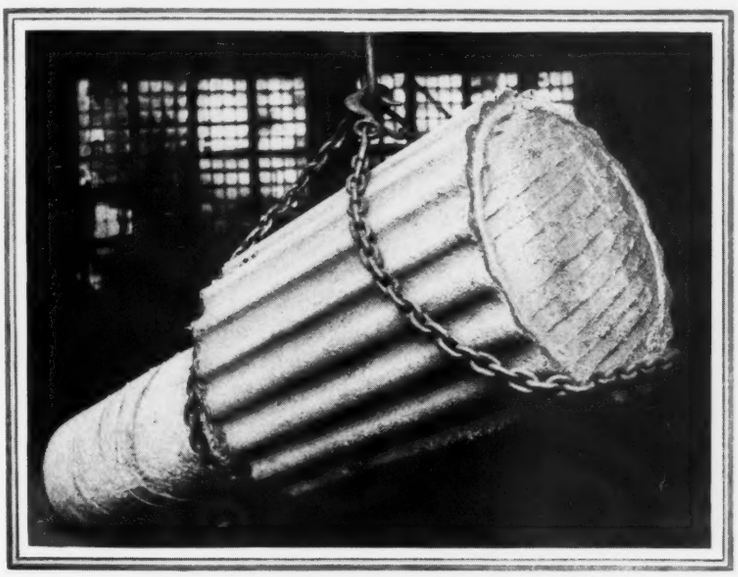
At the recent exhibition of heavy motor vehicles at Olympia, London, a sensation was caused by the appearance of a 100-ton truck, the largest of its kind ever constructed. The vehicle is equipped with an engine of only 80 horsepower, yet it is capable of a speed of five to six miles per hour, and will negotiate a gradient of 1 in 10 and 1 in 11 with its prodigious load. It has fourteen wheels, of which four are employed for driving and six for steering. Braking is provided on twelve of the wheels.

A practical experiment in "education for the educated" has been inaugurated by the Cooper Union Institute of Technology of New York. An evening course has been instituted in physical chemistry, in which 150 graduate engineers em-

ployed in the chemical industries have enrolled. Practically without exception, the men enrolled have already made a success in their respective fields, many as managers and directors of industrial laboratories, department heads, and research engineers in the chemical industry.

Business airplane operation costs are reported to be less than 10 cents a mile for an average low-priced three-place open biplane, according to figures computed by the Western Aircraft Co.

A new General Electric turbine generator to be installed in the Ford Plant at Fordson, Mich., will have an output of 110,000 kilowatts, which far exceeds the rating of any existing prime mover used for industrial purposes. This new machine represents interesting departures in design and construction. It is a vertical compound unit, and is the first large machine to be made to this design. The high-pressure turbine and generator will be mounted directly on top of the low-pressure turbine and generator, resulting in the most compact unit yet proposed. Steam will enter the upper turbine unit at 1200 pounds pressure and, after producing 55,000 kilowatts, will flow into reheaters. In these reheaters, steam at 1200 pounds pressure, direct from the boilers, will reheat the steam exhausted from the high-pressure turbine, which will then flow down and into the low-pressure unit, where it will produce another 55,000 kilowatts.



One of the 35,000-pound Ingots from which the Columns of the Hydraulic Press Shown on the Opposite Page were Forged

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The Mississippi Valley Structural Steel Co. of Melrose Park, Ill., recently constructed four electrically arc-welded pile drivers. Machines of this type are subjected to very heavy duty, involving constant vibration. After many months of service, they have proved to be as rigid as when first built.

Switzerland, it seems, holds the record for the number of patents issued per million inhabitants. According to an investigation, it is stated that in a period when there were 382 patents issued in the United States, there were 542 Swiss patents issued per million inhabitants. The United States holds the second place in this comparison; Sweden, third; Austria, fourth; Germany, fifth; Denmark, Netherlands, Norway, France, and Great Britain following in the order mentioned.

Railroad equipment orders indicate considerable activity in the shops furnishing rolling stock to the railroads. At the beginning of the year there were more freight cars on order than at any similar date during the last four years, the total orders on January 1 reaching nearly 35,000 cars. On the same date, there were 431 locomotives on order, compared with 147 on January 1, 1929, and 93 on January 1, 1928.

Manufacturers in all parts of Canada are watching with great interest the development of a co-operative effort between the metal industries of the Province of Ontario and the Ontario Research Foundation. Briefly, the plan of cooperation provides that the Foundation will furnish laboratories, staff, and facilities, while the overhead and general expenditures of the experimental work will be borne by the metal industries. In this way the industries have at their disposal complete research facilities without the necessity of shouldering the original capital cost. Their share of the cost of the undertaking consists simply of the running expenses. The work will be carried out under the auspices of the Ontario Metal Research Association, which will have headquarters at 47 Queen's Park, Toronto, Ontario, Canada.

The world's largest shovel, capable of placing material 85 feet above the ground, or on top of a seven-story building, is now in operation at the Fidelity Mine of the United Electric Coal Co. in Illinois. Its dipper capacity is rated at 15 cubic yards, but it is estimated that it will hold 20 cubic yards, heaping measure. One dipperful could fill about twenty dump trucks of the one-cubic yard size, or from six to ten big trucks. The dipper has a pulling power of around 100 tons, which would easily be sufficient to lift an ordinary railroad car full of coal. The electric equipment, which was installed by the General Electric Co., aggregates the equivalent of approximately 4500 horsepower. One man controls all the motions and operations of the shovel.

Current Editorial Comment

In the Machine-building and Kindred Industries

MARKING AGE ON MACHINES

Commenting on the brief article published on page 474 of February MACHINERY, which described how the installation date and price paid is stamped on every machine in a certain Ohio shop, a manufacturer writes us as follows:

"We are firmly convinced that if every machine tool that is used in America today had a plate attached to it similar to the one shown in your article, at least 50 per cent of the machine tools now used would soon be replaced, because they have been obsolete for many years and have already been used too long."

Without doubt, if the age of every machine used in industry, whether it be a machine tool or some other type of machine used for manufacturing purposes, were marked on the machine so that it would always be plainly in evidence, there would not be so many machines in use that are thirty, or even forty years old, as there are today.

Obsolete shop equipment cannot compete successfully with new, highly productive machinery. Much has been said about the low return on the investment in many industrial plants. Often this low return may be traced directly to the use of old and inefficient manufacturing equipment.

* * *

PERMANENT VALUE OF TECHNICAL ARTICLES

Last month MACHINERY received two letters from subscribers, inquiring for articles that had previously appeared. One article was published twenty-one years ago and the other thirty-two years ago! This is a striking example of the length of life of technical articles. The information published in mechanical journals is of far more permanent value than the average engineer and mechanic is likely to think. It is a great mistake to assume that mechanical practice changes so fast that there is nothing of permanent value in the periodicals that deal with progress in mechanical engineering and shop practice.

There are many fundamental methods of design that undergo little or no change during a long period of years; and, of course, the basic laws of mechanics do not change at all. Articles clearly describing these fundamentals were found by our two correspondents to be as valuable today as when they were first published twenty-one and thirty-two years ago. This applies to mechanical books as well. Many technical books contain information that is as useful today as when they were first published.

Newspapers and popular magazines are read and thrown away. Copies of mechanical journals are discarded, too, by many subscribers, after they have been read; but the wise engineer or mechanic keeps his copies of mechanical journals or cuts out and files articles that interest him, knowing that this material may be of value to him for many years to come.

* * *

HOW TO SELECT A GOOD FOREMAN

In speaking of how he selects foremen, the works manager of a large plant recently said: "The first thing that I consider is the general attitude of the man toward the firm and toward his fellow workers. He must have a friendly attitude of mind and must have the ability to work well as a member of a team. What we need is teamwork. Of course, technical knowledge of the work and an understanding of our production problems are necessary, but no matter how skilled and capable a man may be, if he is not imbued with the spirit of teamwork, we feel that he will be a failure as a foreman. The spirit of teamwork implies that he will carry out instructions carefully, that he will work in cooperation with his fellow foremen, and that he will handle those working in his department in such a manner as to arouse their enthusiasm and induce them to give of their best."

This works manager, in a few brief sentences, expressed one of the essentials of modern shop management. The larger the concern, the more important teamwork becomes; and whether there is a real spirit of teamwork or not depends largely upon the foremen. The selection of the right kind of foremen is, therefore, one of the most important duties of the management.

* * *

THE CENSUS OF MANUFACTURES

The forms on which manufacturers of machine tools, metal-working machinery, dies, jigs, fixtures, and small metal-cutting tools are requested to furnish information to the Bureau of the Census, for the compilation of the 1929 Census of Manufactures, have just been distributed. The Census Bureau requests that these forms be filled in and returned to the Bureau at the earliest possible moment. If manufacturers will furnish the information promptly, the Bureau will be in a position to prepare complete statistics at an early date. It takes only about three weeks to furnish the complete statistics of an industry, from the time that all the reports from the manufacturers in an industry group have been received.

Reducing Costs by Planning Production

How a Corporation Manufacturing 23,000 Stock Items Has Improved Inventories, Reduced Costs, and Decreased Labor Turnover

By HOWARD COONLEY, President, Walworth Co., Boston, Mass.

THE question has been asked "Is it possible to make a sufficiently accurate estimate of future business, so that the amount of production may be planned and sales and expenditures budgeted with reasonable accuracy a year ahead?" Basing my answer on the experience of the Walworth Co. for the last ten years, I am able to say "Yes—emphatically, yes." We have been successful in doing this very thing in our company for the last ten years. During that period, we have never overestimated the volume of business for the coming year; as a matter of fact, our estimate has averaged within 4 per cent of actual performance—that is, our sales, on an average, have been 4 per cent greater than our estimates.

Howard Coonley, President Walworth Co.

The greatest difference between estimate and actual performance was for the year 1929, which proved to be 8 per cent better than our original, unadjusted estimate; but if we allow for special sales efforts that matured successfully after the budget was approved, the performance was within 1 per cent of the estimate.

How to Prepare the Way for Making Accurate Estimates

Fifteen years ago we first conceived the idea that it would be possible to estimate sales and plan production for a considerable period in advance. We were told that this could not be done with a business having so diversified a line of output as the Walworth Co. The total number of separate items made by this company, including valves and fittings made from cast iron, malleable iron, brass, and steel, and pipe and tools is approximately 23,000.

The first step was to classify these items into a dozen main groups. Then, the sales of each of these groups for a number of years were studied and curves were plotted to show the variations in the volume of business in each group from year to year and from season to season. The curves for the different groups were next combined into a general curve, showing the trend for the entire business. With these curves, together with the general business curves prepared by various agencies that have studied the business cycle, as a basis, it was possible to estimate accurately the volume of business for one year in advance. Projecting the curves of sales twelve months ahead is not so difficult as it may appear, for business follows quite consistently in the footsteps of past performance.

As a detailed procedure, the planning department's estimates of demand are adjusted here and there by the sales and production departments of the company. On the basis of these estimates, the three departments record, independently of each other, the volume of production required to meet the estimated demand from month to month. The chief executive then studies these separate estimates in connection with his own forecast, and determines the production schedules for the different groups of manufacture.

Each month the estimate is compared with the actual sales. If a serious discrepancy appears between estimated and actual performance, adjustments are made before the results become serious. When there is a falling off in sales, an investigation is made immediately. Sometimes the trouble may be due to some local condition that is easily remedied by additional sales effort in a given territory. Sometimes unexpected and wholly unforeseen business conditions in some part of the country may decrease the sales there; but whatever the cause, the main thing is to find it and to determine whether a remedy is available.

After having proved that it was practicable to estimate sales, plan production, and budget expenditures, the next step was to make a complete financial estimate in advance and to forecast the profits of the business. When this forecast indicates that the profits are likely to be small in a certain year, expenses are reduced and aggressive counteracting measures are developed wherever possible.

Results Obtained Through Planning and Budgeting

The three main results achieved by a careful method of estimating sales and planning production in advance are a reduction in the per-unit-of-service cost of carrying inventories, a reduction in the cost of manufacture, and a decrease in the labor turnover.

The effect of budgeting on inventories is most remarkable. In fact, it is the only method by which inventories may be properly controlled. Experience shows that many firms carry in their inventories a sufficient number of parts of certain items to last them for ten years or more. Under these conditions, the carrying charges consume all possible profits. The importance of holding down inventories to the smallest possible volume consistent with immediate deliveries is self-evident.

The cost of manufacture is lowered, because there is a more even flow of production. This results in less overtime, due to better planning, and makes it possible to keep approximately the same force of labor steadily employed throughout the year. With a reduced labor turnover, the loss incident to hiring and breaking in new men is decreased. Equally important is the attitude of the employes which results from the knowledge that, as far as possible, the company will provide them with steady jobs. We have noticed a decided improvement in this respect throughout all the plants of the company.

The Prospects for the Immediate Future

And now it is evident that someone will ask, "In view of the accurate estimates that your company has been able to make in the past, what are you predicting for business in 1930?" Our estimate for our own line of business is that the volume of "ordinary" sales in 1930 will be equal to 95 per cent of the 1929 volume. The past year was, in many ways, an unusual one. It would not be reasonable to expect 1930 to be quite so good as 1929. On the other hand, the latter months of 1929 showed a decided decline, which will continue into the early months of 1930. The curve, however, will soon begin to move upward, and the total volume of "ordinary" business for 1930, as stated, will be very little below that of the past year.

The percentage figure given will not, of course, apply to all businesses. In some lines, the volume may be more nearly equal to that of 1929; in others, the falling off will be considerably greater. Our estimate, of course, applies only to our own line of "ordinary" business. Needless to say, however, we shall again lay plans to make sales at least as great as in 1929.

In conclusion, it may be said that any executive who wishes to plan his business properly can do so if he will follow a few simple rules. First, he should classify his product in a few broad groups; then, he should study past sales of these groups and prepare curves that show the general trend in his line of business for a number of years past. From such a study he can project his curves into the future and estimate with a fair accuracy the demand for his product for a reasonable period to come. With this knowledge, he will be in a position to adjust policies so as to assure continuing profits.

* * *

STANDARD FOR LETTERING ON DRAWINGS

A standard for lettering on drawings is being proposed under the procedure of the American Standards Association, and is jointly sponsored by the American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education. The proposal showing the lettering that the committee recommends is now available, and copies may be obtained by addressing C. B. LePage, assistant secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City. The proposal is as yet in a tentative form and is distributed for discussion. Suggestions will be welcomed.

At one time, it was the general opinion that lettering should be sloped as in script, thereby combining uniformity and speed. A number of letter forms have been promulgated but, in apparent contradiction to theory, the vertical letter has been adopted by many of the larger manufacturers as being the type of lettering that tracers can make legibly and uniformly. As in script, sloped letters invariably carry personal characteristics of the individual; this feature is not so noticeable where vertical letters are used. It has also been found that vertical lettering produces work that is more legible in the blueprints.

In a questionnaire recently sent to the industries and educational institutions, it developed that the industries are in favor of the vertical lettering and the educational institutions the inclined lettering. In making recommendations for a universal type of lettering, it seems desirable to be governed by the group that uses it in practice.

It is not desirable to grade the size of lettering with the size of drawing except when a reduced photographic reproduction of the drawing is to be made. Otherwise the size of the lettering should be such as will produce legible prints, and should be governed by the nature of the original, if on tracing cloth or tracing paper, and in ink or pencil.

* * *

As an indication of the importance attached by the Government to the use of welding in the construction of naval vessels, it is of interest to note that in announcing an open competitive examination for the position of senior welding engineer, the Government offers the highest entrance salary paid to any engineer in the United States Civil Service.

THREADING NUTS BY END-MILLING

By ALFRED KRASKE, Assistant Superintendent
A. B. See Elevator Co., Jersey City, N. J.

Great savings in time have been effected at the plant of the A. B. See Elevator Co., Jersey City, N. J., through the adoption of the end-milling process for cutting internal threads on large brass nuts used on elevator safety equipment. One of these nuts is shown at *A* in Fig. 1. The screw that

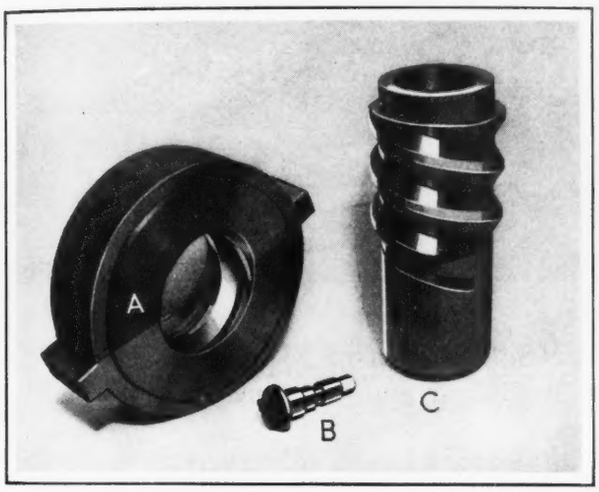

Fig. 1. Nut A Threaded to Fit Screw C by Using the End-mill B

fits this nut is shown at *C*, and the cutter used in milling the thread in nut *A* is shown at *B*.

The lead of the thread in the nut shown is 2 1/4 inches, and there are two threads. The included angle between the sides of the thread is 120 degrees. This thread was designed to give a high lead or rapid advance and at the same time develop sufficient friction to make the nut and screw non-reversible under specific pressures. The pitch diameter of the thread is 2 11/16 inches. The whole depth of the thread is 0.1975 inch, and the addendum, 0.09375 inch. The cutting or helix angle is 14 degrees 55 minutes 20 seconds.

The thread milling operation is performed on a Pratt & Whitney thread miller equipped with a special attachment, as shown in Fig. 2. The special equipment consists essentially of a 1/2-horsepower motor *E*, which runs at a speed of 1300 revolutions per minute, and the tool *F*, provided with the cutter *D*. The spindle *H* of tool *F* is connected directly to the motor by a flexible coupling *G*. Cutter *D* is driven by shaft *H* through a pair of spiral-bevel gears having a ratio of 1 to 1. These gears provide a drive at right angles to the motor shaft.

The arbor or body of the tool and the milling cutter are made small enough to pass through the hole in the nut. The body of the tool *F* is clamped in the holding block *J* and does not revolve. The rotation of the chuck holding the nut *A* is synchronized with the movement of the carriage that supports the thread-milling tool and the motor *E*. At the beginning of the threading operation, the cross-slide is adjusted to cut the thread to the full depth. Cutter *D* is fed into the work by engaging the lead-screw of the machine, which causes the carriage to move longitudinally on its ways. Thus, one of the double threads is milled by a single cut.

After milling the first thread, the cross-slide is moved back to allow the cutter to clear the work. The tool is then withdrawn from the nut and indexed for cutting the next thread. The operation of cutting the second thread is exactly the same as for the first thread. Cutter *D* may be described as a four-lipped angular or conical-shaped end-mill. The direction of rotation, or the hand, of the cutter depends on whether a right- or a left-hand thread is to be milled. Cutters of this kind can be made very easily and they can be sharpened readily.

The nozzle of an air line inserted in the spindle at the end farthest from the cutter, serves to blow the chips out of the cut. The average time required for cutting the two threads in one of the nuts is 8 minutes. As the setting-up time is 7 minutes, the total time required is 15 minutes. This represents a great saving over the old method of using a single tool in a lathe, which required from 3 1/2 to 4 hours.

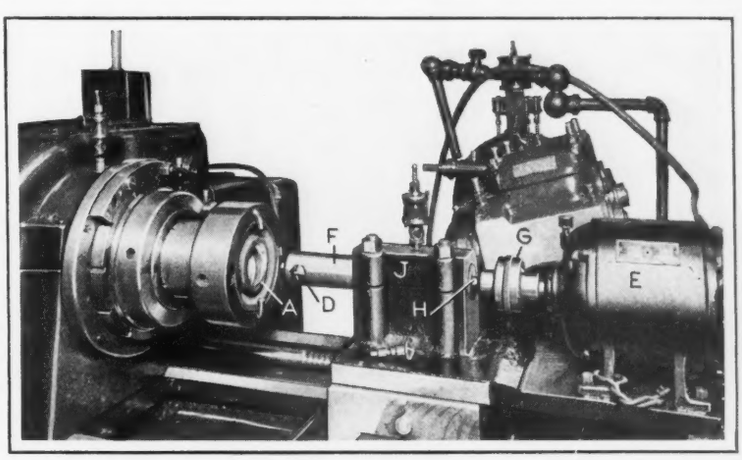

Fig. 2. Cutting a Quick-lead Double Thread in a Brass Nut by End-milling

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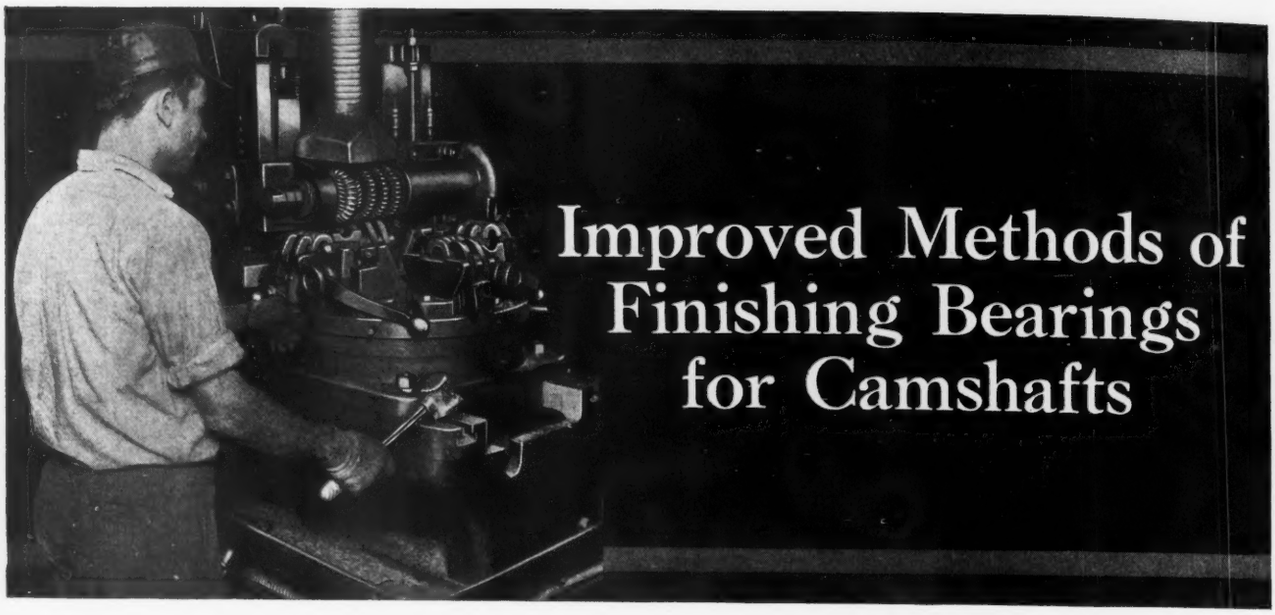
LEATHER BELTING STANDARDIZATION

A conference of manufacturers, distributors, and users of leather belting was held under the auspices of the American Standards Association at the Engineering Societies Building, 29 W. 39th St., New York City, on February 6, for the purpose of determining whether national standards for leather belting ought to be established. The conference convened at the request of the American Society of Mechanical Engineers. Twenty-two organizations were invited to attend, including engineering, power transmission, belting, and textile machinery associations.



Improved Methods of Finishing Bearings for Camshafts

Great Savings in Time are Effected by the Substitution of Milling for Boring and by the Use of a Special Drilling, Reaming, and Tapping Machine

By CHARLES O. HERB

IMPORTANT economies in manufacturing can often be effected by the adoption of methods differing radically from those that have been used so long that they are thought of as preferred practice. Milling was recently adopted in place of boring at the plant of the Packard Motor Car Co., Detroit, Mich., for finishing the bearings for the camshafts of the engines built by that concern.

This change, together with the use of a horizontal indexing type of machine used for drilling, counterboring, and tapping bolt holes in the bearing castings, as well as for drilling and reaming a dowel-hole, has resulted in a saving of 17.7 minutes in producing a set of bearings for one type of automobile, and 15.4 minutes for another type. The actual return on the capital invested in this equipment is 44.2 per cent.

These camshaft bearings are gray iron castings of the design illustrated in Fig. 2; the upper half is shown at *X*, and the lower half at *Y*. Bore *A* of each casting is the surface now finished by milling instead of boring.

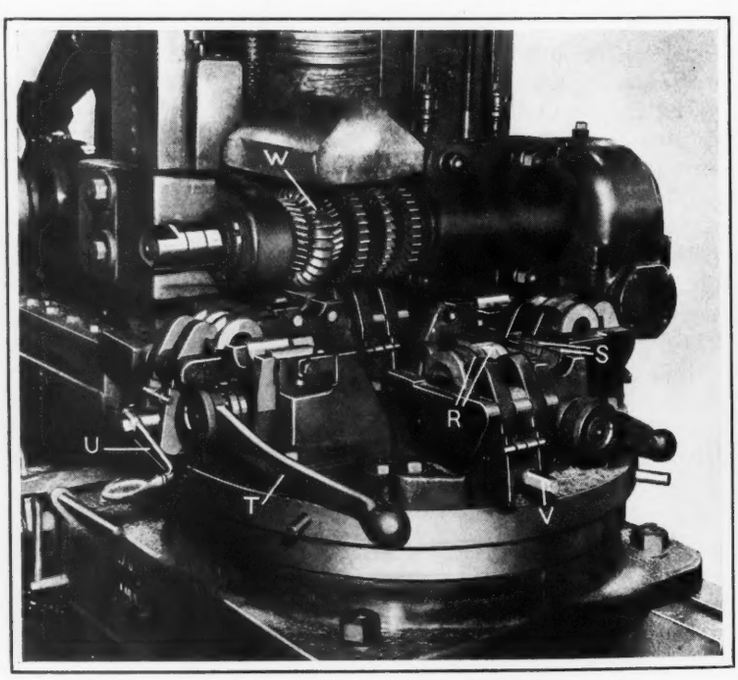


Fig. 1. Milling the Bore of Camshaft Bearings and Several Flat Surfaces at the Same Time

Milling Substituted for Boring

Several other surfaces of the bearings, in addition to bore *A*, are finished by milling. All these cuts are taken in "Producto-Matics," which are set up as shown in Fig. 1, with a four-station indexing table. Means are provided at each station for holding two bearing halves with the rounded portion up as shown at *R*, and for holding two more halves with the bore surface up, as indicated at *S*. The four halves are quickly clamped in place by tightening handle *T* and applying crank *U* to the square end of shaft *V*. Equalizing members hold the parts with uniform pressure.

Seven cutters are mounted on the arbor for machining simultaneously the four bearing cast-

ings as each station is indexed to the cutters. During the operation, the cutter-head first moves downward to bring the cutters to the proper height for machining the surfaces and then moves horizontally toward the rear to finish the surfaces for their entire length. Next the cutter-head rises so that the cutters will clear the work, and, finally, moves forward to its starting position. All movements of the cutter-head and of the indexing table are fully automatic.

Cutter *W*, Fig. 1, which is rounded to a true radius, mills bore *A*, Fig. 2, of both bearing halves to size within +0.000 and —0.002 inch. Simultaneously, the two cutters beside cutter *W* mill the two joint surfaces *B* of each half, while the other four cutters mill sides *C* of the two halves that are held with the rounded portions up.

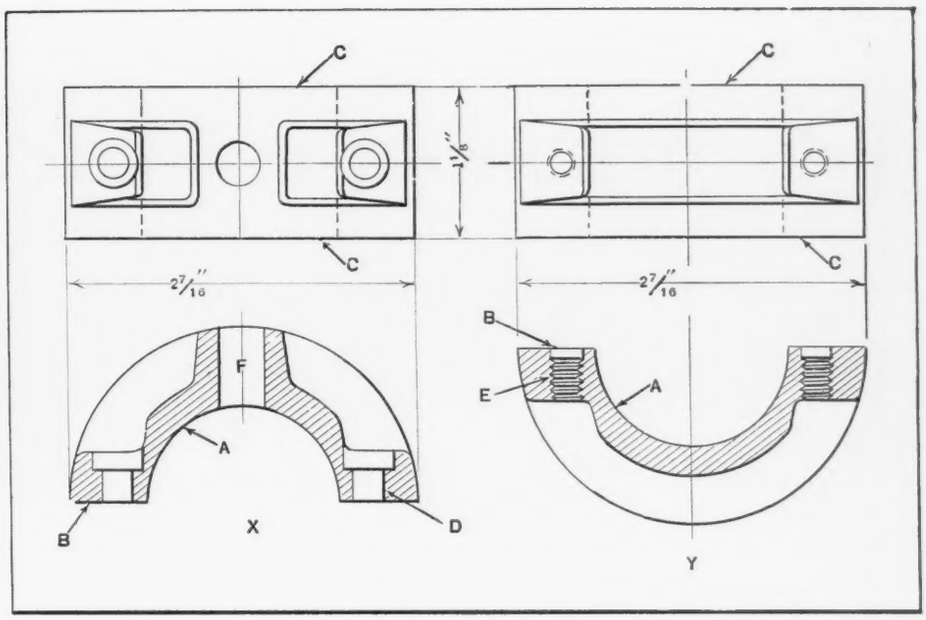


Fig. 2. Upper and Lower Halves of Bearings Provided for Packard Camshafts

The practice is to place the bearing castings in the fixtures with an upper and a lower half together, so that two mating halves are finished at each indexing of the table. They are face-milled during the first indexing, so that they can be accurately positioned for form-milling the bore when they reach the cutters the second time. For the face-milling, the castings are located from the unmachined bore. Each machine produces approximately 92 pairs of bearings per hour.

The use of the form cutter for milling the bore has eliminated core-drilling, boring, and reaming operations which were necessary with the previous practice after the joint surfaces and the faces had been milled in two separate operations.

Special Machine Eliminates Three Operations

By the methods formerly used, four distinct operations were required for drilling and counterboring bolt holes *D*, Fig. 2, drilling and tapping holes *E*, and drilling and reaming dowel-hole *F*. All these cuts are now taken in one operation by means of the Hammond opposed-head multiple-spindle machine illustrated in Fig. 3.

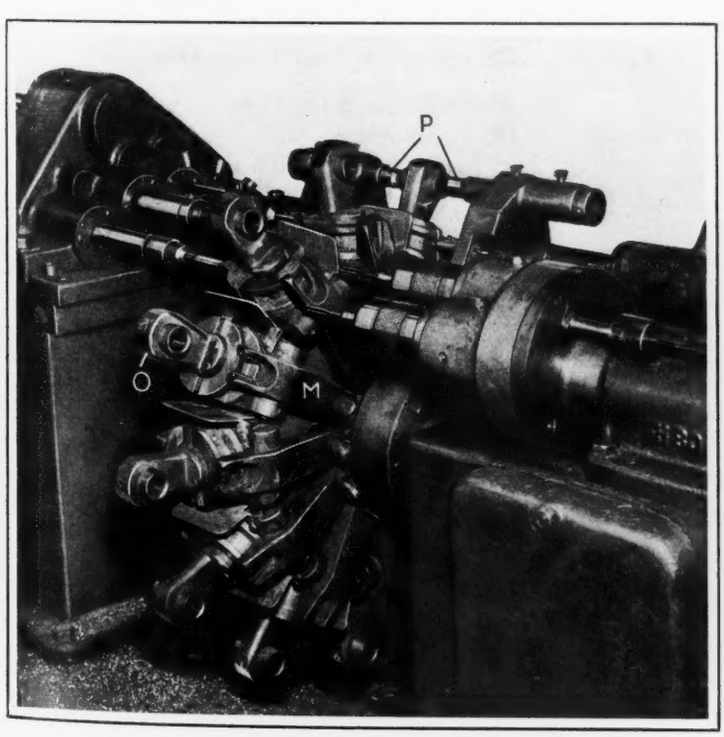


Fig. 3. Semi-automatic Machine which has Reduced the Time and Equipment Formerly Required for Drilling, Tapping, and Reaming the Bearing Castings

Each pair of bearing halves is located from the bore on the hardened shank of an extending arm, such as seen at *O*, which is provided with a bushing that insures accurate location of the work while being drilled. Two pilots *P* enter the bushing from opposite sides. The parts are held firmly on opposite sides by means of fingers *M*, which have rollers at their inner ends that ride on cams; thus, the fingers are automatically clamped on newly loaded pieces and automatically released after the operation has been performed, so as to discharge the work into the pan of the machine. Reloading of the parts is performed on the side of the machine opposite to that shown.

In the first indexed position, the bolt holes of both halves are drilled and those of the upper half are counterbored; in the second position, the dowel-hole is drilled; and in the third position the bolt holes of the lower half are tapped while the dowel-

Fig. 4. Fixture Used in Assembling Bearing Castings

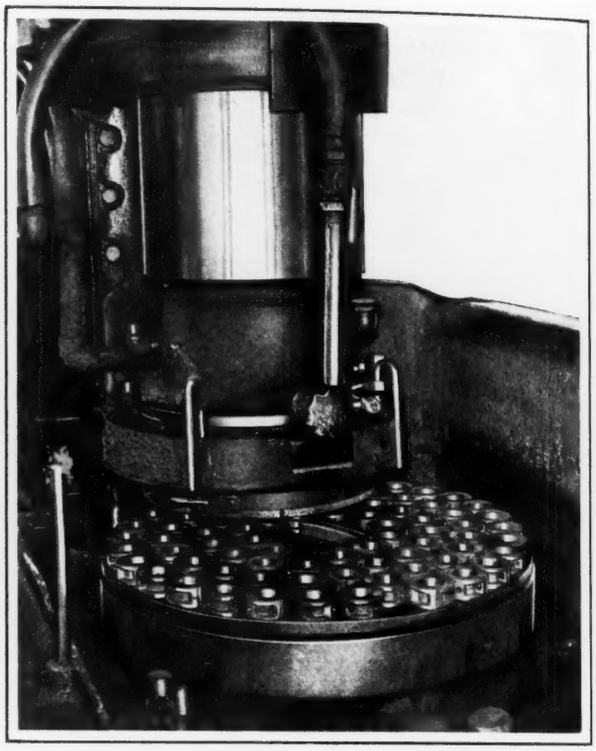


Fig. 5. Surface Grinding the Sides of the Bearings

hole is reamed. The production on this machine is 316 pairs of bearings per hour.

Assembling Bearing Halves

The burred edges of the milled surfaces are next smoothed off by rubbing them over emery cloth, and then the top and bottom halves are assembled to form the complete bearing. This assembly is facilitated by the fixture illustrated in Fig. 4. Six bottom halves are placed in seats which are free to rock a limited amount, and an arbor that fits the bearing bores is advanced through them from the left- into the right-hand head of the fixture, by turning a capstan wheel.

After the top halves have been placed on the bottom halves, machine screws are started into the holes with a hand screwdriver. Finally, an electric drill equipped with a screwdriver is employed to finish driving the screws in. Approximately 1400 sets of bearings are assembled per nine-hour day by one man. The arbor lines up each half bearing accurately with its mate.

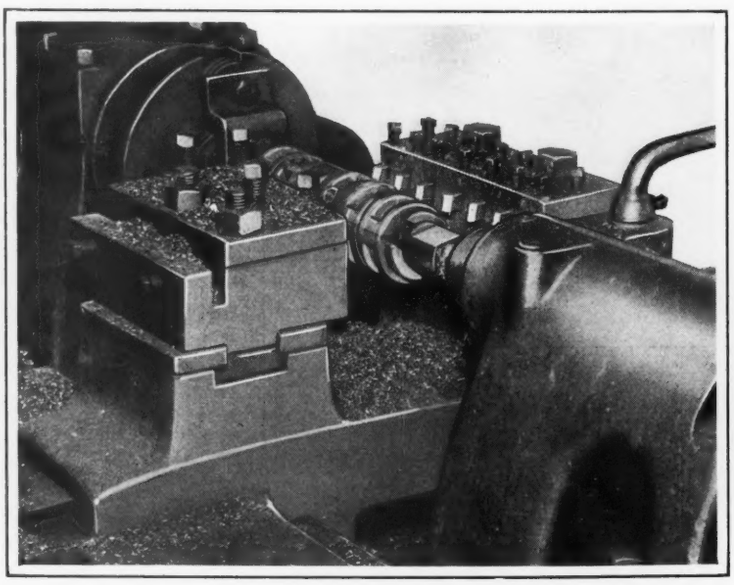


Fig. 6. Turning and Chamfering Six Bearing Assemblies

Sides *C*, Fig. 2, are next ground to bring the width of the bearings to size within $\pm$ 0.002 inch. This operation is performed on a Blanchard surface grinding machine with the bearings positioned on the magnetic chuck, as illustrated in Fig. 5. Approximately 1/16 inch of stock is removed from each side of the bearings during this grinding operation.

Turning Six Bearings at One Time

The assembled bearings are turned in lathes set up as shown in Fig. 6, with six bearings mounted together on one arbor which is placed between the centers of the machine. A washer separates each bearing sufficiently to permit of chamfering the corners. The parts are turned by two tools mounted on the front toolblock and then chamfered by the seven tools on the rear block. Accuracy of the operation is insured by stops.

Figure-eight oil-grooves are cut in each bearing by employing a Fischer oil-groover, as illustrated in Fig. 7. The assembled bearing

is held in a two-jawed chuck and revolved as the carriage is oscillated to move a single-point tool back and forth across the bore. The proper depth of groove is obtained by feeding the carriage transversely against a stop.

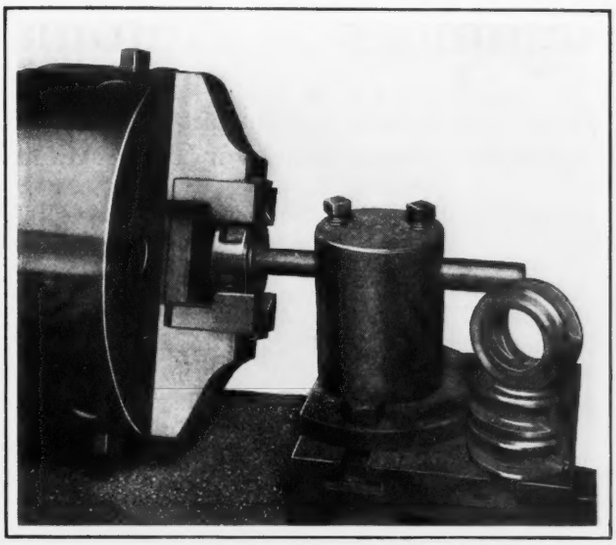


Fig. 7. Cutting Figure-eight Oil-grooves in the Bearing Bores

Internal and Cylindrical Grinding Operations

The bore of the bearing assemblies is automatically ground to size within ± 0.0005 inch in Heald "Size-Matic" internal grinding machines. Two bearings are held at a time in special chuck jaws, as shown in Fig. 8. At the end of this operation, two bearings are mounted on an arbor and ground on the outside in a standard cylindrical grinding machine.

* * *

BERYLLIUM—A METAL OF THE FUTURE

Beryllium is a metallic element somewhat resembling both magnesium and aluminum. Its specific gravity is very low—1.64, or less than that of magnesium. Its strength is very high, comparable to that of steel; the modulus of elasticity is also about the same as that of steel; the coefficient of thermal expansion and the melting point are about the same as those of cast iron; and its resistance to corrosion is greater than that of aluminum. Unfortunately, however, in spite of the fact that beryllium possesses these excellent properties, it has one serious fault as a structural metal—it lacks ductility.

According to Dr. C. B. Sawyer, in a paper read before the Cleveland aeronautic meeting of the Society of Automotive Engineers, there is no doubt, however, that sufficiently ductile alloys, consisting almost entirely of beryllium, can be prepared in the future. The achievements in the use of tungsten are an indication of what may be expected. The task of preparing ductile alloys of high beryllium content is not, however, easy, although alloys of somewhat less beryllium content give much encouragement. Light ductile alloys of beryllium and aluminum, containing up to 60 per cent of beryllium, have been made and are reported to have shown a tensile strength of 80,000 pounds per square inch.

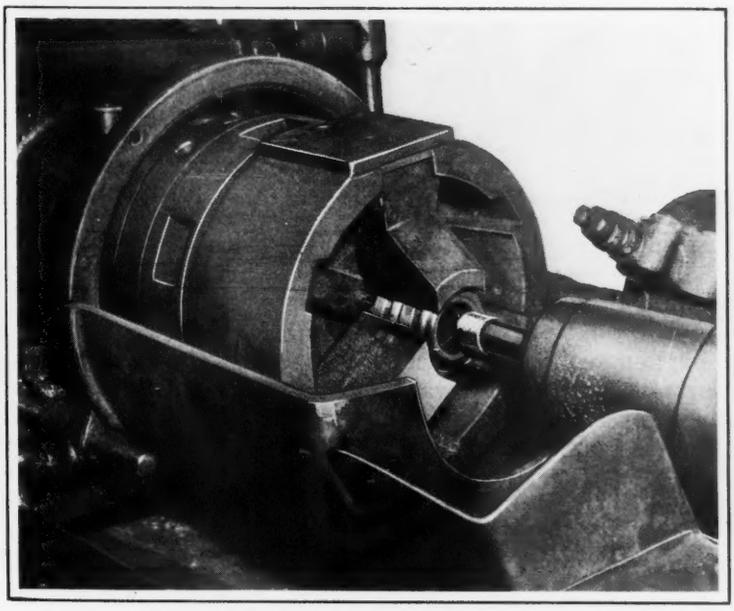


Fig. 8. Grinding the Bore of Two Bearings to Size in an Internal Grinding Machine

Beryllium has long been regarded as a rare element, but the facts have proved it not to be so. Its position as the fourth in the periodic table of chemical elements places it midway among the first nine elements, every one of which is known to occur in large quantities, and as interest in beryllium has increased, so have the known deposits of the ore beryl. This ore can now be obtained in carload lots at from $50 to $60 per ton. It is believed that a contract for considerable quantities of this ore would reduce the price to from $20 to $30 per ton. With this cost of the ore, it is estimated that if production were organized on a large scale, and with well developed processes, beryl could be produced for from $2 to $3 per pound, which would make it possible to use it for many industrial purposes.

* * *

WAR DEPARTMENT SEEKS RESERVE OFFICERS FOR PROCUREMENT DIVISION

Benefiting from past experience, the War Department is taking active steps to have an adequate purchasing service ready to function in case of an emergency. For this purpose, the War Department desires an additional number of reserve officers for assignment to various units in the procurement service. These men will receive training during peace time so that they may aid in the efficient purchase of supplies for the government in an emergency. Anyone interested in this matter is invited to correspond with Colonel James D. Fife, Director, Planning Branch, Office of the Assistant Secretary, War Department, Washington, D. C.

Annealing Stampings in Automatic Furnace

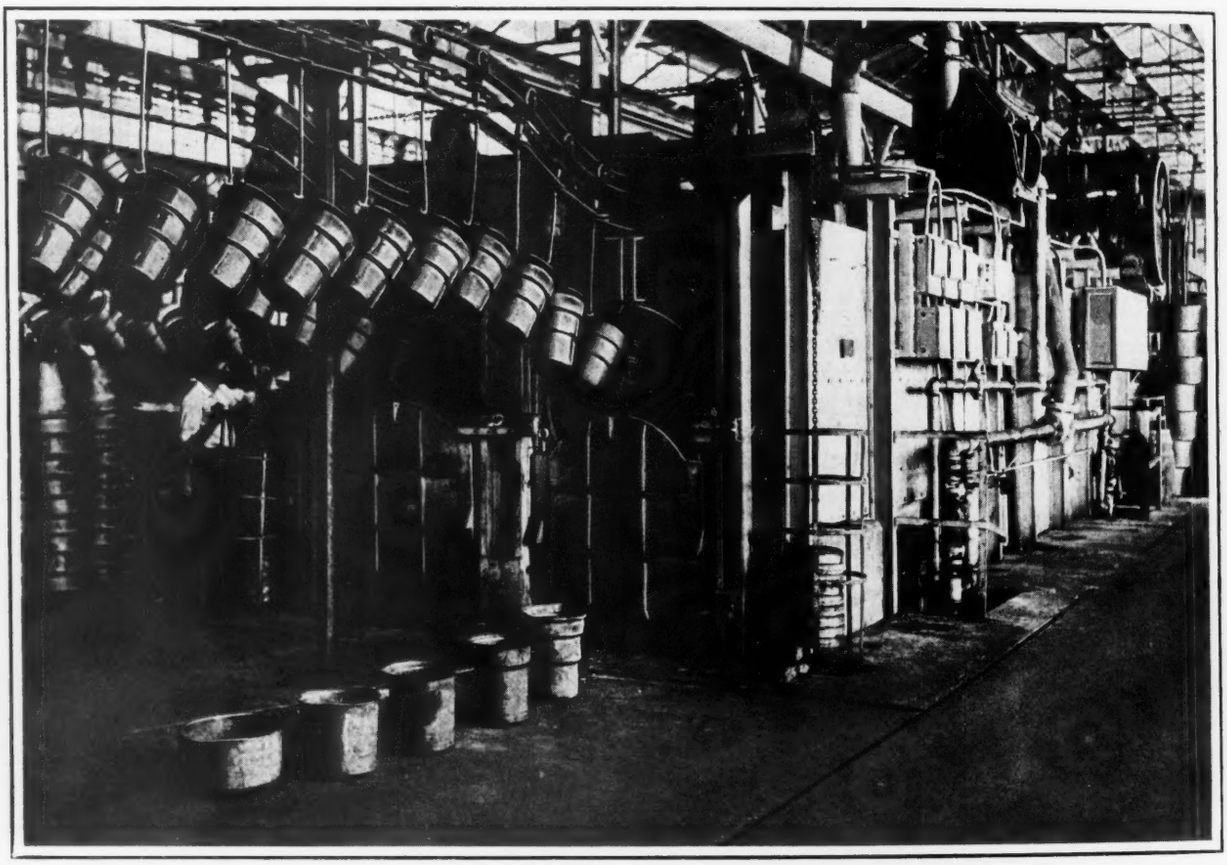
Continuous Operation and Increased Output are Obtained in Annealing Drawn Sheet-metal Parts in a Conveyor Type Automatic Furnace

By W. M. HEPBURN, Vice-president, Surface Combustion Co., Toledo, Ohio

THE production of sheet-metal stampings requires a great deal of specialized knowledge of equipment, methods, and materials. It is for this reason that many concerns requiring metal stampings, including the large automobile plants, still employ manufacturers specializing in this branch of the industry to make their stampings.

The drying tank is made from 16-gage sheet iron and is 14 inches deep. It is 10 inches in diameter at the top, and 8 inches at the bottom. It is made by a series of drawing, annealing, and redrawing operations, as indicated by the samples shown on the floor in the illustration.

The furnace used for the annealing operation, together with the conveyor arrangement, was built by the Surface Combustion Co., Toledo, Ohio. The furnace is of brick construction, reinforced with channels. It is 53 feet long, 10 feet high, and 6 feet wide. The conveyor, which is of the overhead chain type with hooks on which the work is hung, is 130 feet long and forms a closed loop. As the work is hung on the hooks after each drawing operation, it is carried through the furnace and returned to the press, as mentioned. Another shorter conveyor runs inside and parallel to this conveyor, as mentioned later.



Continuous Automatic Furnace with Conveyor Passing Drawn Parts to be Annealed through it

The Mullins Mfg. Co., Salem, Ohio, is one of the firms specializing in automobile sheet-metal parts. This firm also makes many other kinds of stampings.

One of the interesting parts made in this plant is a sheet-iron drying tank, and another is a sheet-copper wash tub, both parts of a well-known washing machine. In making the wash tub, a number of draws and anneals are necessary. This tub is made from 32-ounce sheet copper, and when completed is 22 1/4 inches in diameter by 13 inches deep. The drawing of the tub is done in a large toggle press. An overhead conveyor forming a closed loop, carries the tubs through the annealing furnace, returning them to the press after each annealing operation.

The furnace is divided into three zones for preheating, heating, and cooling. The heating zone, which is 17 feet in length, is maintained at 1650

degrees F. The temperature in the furnace is automatically kept at the correct level by a pyrometer connected with a recorder. The pyrometer is also connected with four thermo-couples in the hot zone and two motor-operated valves on the gas supply lines.

The conveyors are motor-driven through speed reduction gear trains, and their speed is so regulated that the work remains in the furnace the proper length of time for annealing, which, in this case, is approximately 14 minutes. Under the furnace, and at each end of the hot zone there is a tunnel, running crosswise. In each tunnel are located two gas burners which fire under the hearth. An air blower on top of the furnace supplies air to these burners. The gas-to-air ratio can be so proportioned as to obtain any furnace atmosphere desired. In the present case, an atmosphere having a slight excess of gas is necessary to prevent scaling. The correct gas-to-air ratio is automatically maintained, regardless of variations in the volume of material passing through the furnace.

The furnace is of the "counterflow" type, being divided lengthwise into two chambers, each provided with a conveyor, the two conveyors running in opposite directions. In this way, the hot outgoing work gives out a considerable amount of heat to the cold work entering at the same end. The hot zone is located in the middle and the hot products of combustion flow both ways, so that the preheating and cooling zones at each end of the furnace become also heat interchange zones. The heat cycle of 14 minutes is divided into 4 minutes in the preheating zone, 6 minutes in the hot zone, and 4 minutes in the cooling zone.

The openings in the furnace through which the work passes in and out are approximately the size and shape of the tubs and tanks to be handled, so that only a small amount of cold air enters and a small amount of hot air escapes. Counterweighted doors are provided for the openings. These doors are, of course, kept closed when the conveyors are not operating.

The Use of Electric Spot Welding

By A. M. SEARLES, Factory Representative and Engineer, Acme Electric Welder Co.

Spot welding, or the fusing of two or more pieces of iron, steel, or other metals, in small areas known as spots, is not a new art. However, in the last few years considerable progress has been made in the development, general application, and varied use of spot welding in the fabrication of metals.

The process consists of fusing two or more overlapping metal sheets or bars by passing a suitable electric current through small areas with electrodes pressed firmly against opposite sides of the metal. It is preferable that the parts joined be free from scale or other foreign matter. Electric spot welding is a form of resistance welding, and is accomplished by the aid of mechanical and electrical equipment which is designed to perform automatically the five following operations in the sequence given:

1. Apply pressure for holding the pieces of metal together.
2. Apply current, which heats the metals to the proper state for fusion.
3. Disconnect current just before the metals are completely melted.
4. Apply more pressure to unite the metals firmly in fusion.
5. Release pressure to permit removal of the work.

The time required to complete one spot weld as outlined or, in other words, to complete the welding cycle, ordinarily consumes only a fraction of a second. With a spot welding machine of modern design, a spot weld is made at each full stroke of the treadle. The operator can make an almost indefinite number of uniform spot welds with such a machine by simply actuating the foot-treadle.

Spot welding is used extensively in the manufacture of automobiles, metal furniture, steel bookcases and cabinets, wrought-iron specialties, bank and office fixtures, galvanized articles, tool boxes, garbage and ash cans, lockers, steel shelving, ranges, and hundreds of other products. This extensive use of spot welding may be attributed to the great saving in labor and the substantial reduction in manufacturing costs.

A spot weld provides a strong and a neat appearing joint. No great experience is necessary to operate a spot welder and a novice becomes expert at the work in a very short time. With the spot welder the current is reduced from a high voltage to an extremely low voltage, so that there is no danger of the operator becoming injured from an electrical shock.

There are no definitely fixed values for the amount of current, pressure, or time for spot welding various gages or qualities of the same or dissimilar metals. By a limited amount of experimenting with the particular metals to be welded, and by adjusting the current, the pressure, and the time, the making of spot welds is often satisfactorily accomplished under circumstances that ordinarily seem most unfavorable.

* * *

Standardization of minor parts and fittings is one of the most important factors contributing to the reduction of automobile prices. The annual saving to car buyers in the United States and Canada resulting from this one activity of the Society of Automotive Engineers is estimated to be $840,000,000.

Arc-Welded Jigs, Fixtures and Machines*

Methods Employed in Building From Two Hundred to Four Hundred Jigs and Fixtures per Month, as Well as Special Machines

By J. R. WEAVER, Superintendent, Manufacturing Equipment Department, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

THE construction of jigs and fixtures by arc-welding was practically forced on the Westinghouse Electric & Mfg. Co. about a year ago when it became necessary to obtain a large number of jigs, as well as some special machines, upon short notice. When orders were authorized for jigs requiring castings, approximately four weeks elapsed before the castings were delivered to the shop, whereas it was found that arc-welded jigs of the most complicated design could be made in one week or less; the average time is four days.

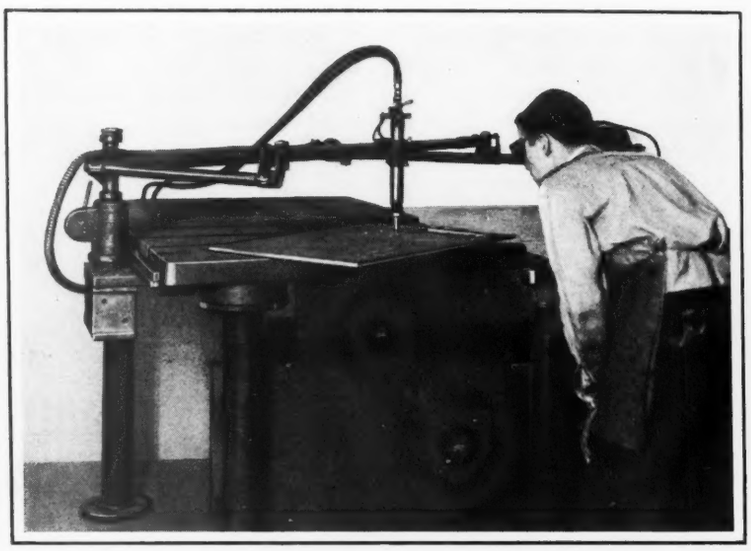


Fig. 1. Cutting out Detail Jig Parts from Steel Plate on an Oxy-acetylene Cutting Machine

Several jigs were built and thoroughly tested to determine their suitability, and then a definite program of manufacture was decided upon, which has given very satisfactory results. It had been thought that arc-welded jigs and fixtures would not maintain their shape after a period of time, but those in use for about a year have required less attention than cast-iron jigs.

From 200 to 400 welded jigs and from 3 to 6 special machines are now built per month. The average cost of the jigs is approximately 25 per cent less than it would be if iron castings were used in their construction. Also, the jigs and fixtures are more desirable than cast-iron ones, owing to the fact that they are lighter and, at the same time, of at least equal strength.

Materials Used in Making Arc-welded Jigs and Fixtures

Hot-rolled steel pieces of proper shapes and sizes are welded together to form the jigs and fixtures.

*Abstract of a paper read before a joint meeting of the Metropolitan Section of the American Society of Mechanical Engineers and the New York Section of the American Welding Society, in New York City,

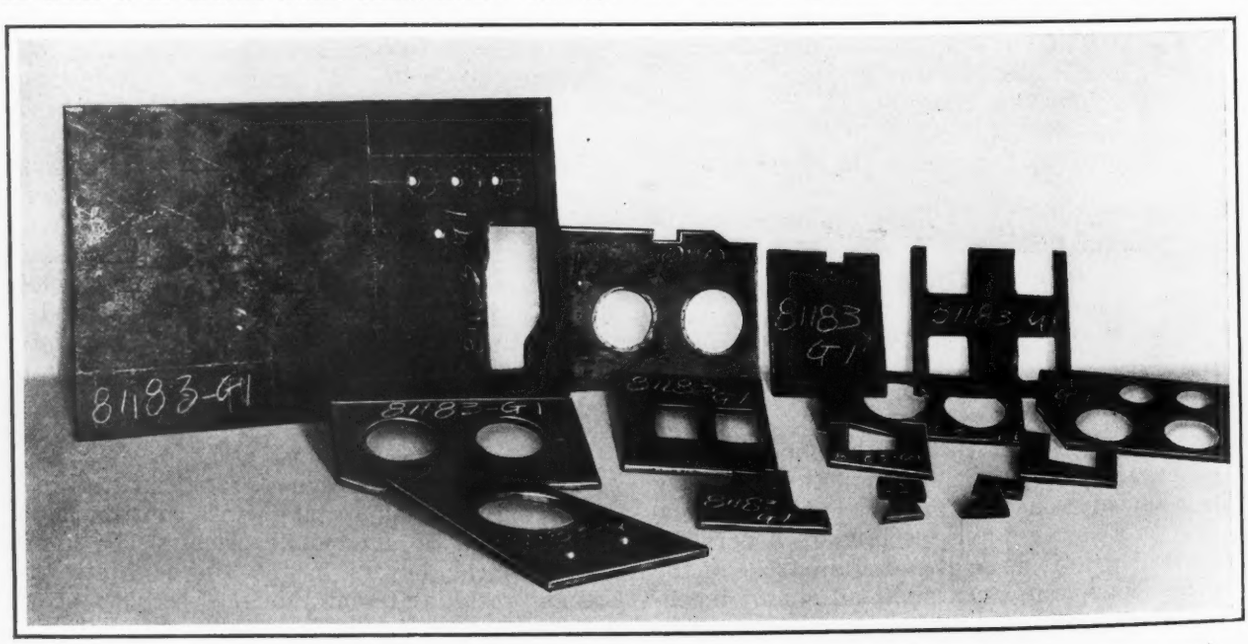


Fig. 2. Typical Detail Parts Used in the Construction of Arc-welded Jigs and Fixtures

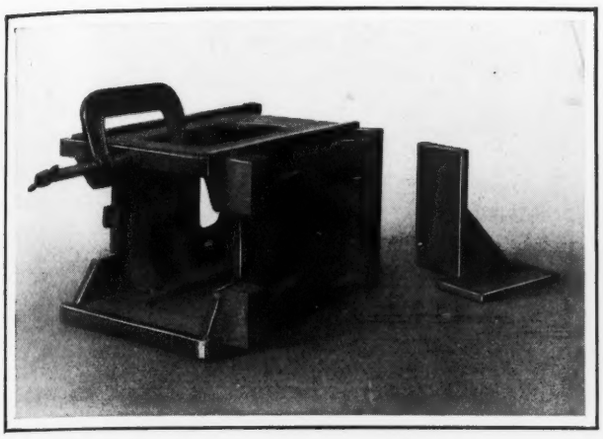


Fig. 3. Jig Body Partially Tack-welded Together, This Assembling being Performed by a Machinist

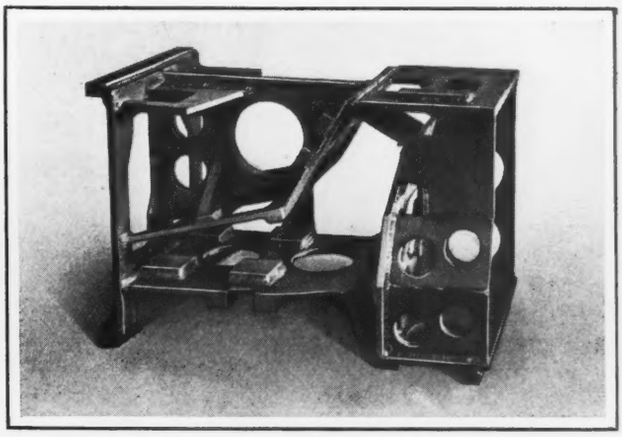


Fig. 4. Appearance of a Completely Welded Drill Jig Body before being Sand-blasted and Painted

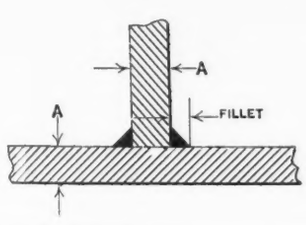
Wherever hardened pieces are required, these are made of tool steel, hardened, and then attached to the jigs by means of screws, bolts, etc. Bushings are pressed into holes provided for them.

Some trouble was experienced at first with the jig feet, owing to the fact that after a jig was annealed, the feet were so soft as to permit metal chips to become embedded in them. To overcome this, the feet are now made from tool steel and hardened before being welded to the jigs. The feet are drawn to a Scleroscope hardness of from 45 to 50, which is sufficient to eliminate the previous difficulty, but low enough so that they can still be machined.

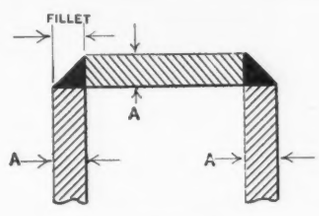
Welding Information Provided by the Tool Designers

It was found necessary to train the tool engineers in the art of welding to such an extent that they could provide proper information on sketches sent

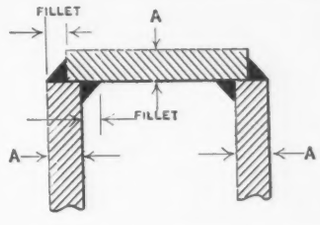
Sizes of Fillets and Welding Rods for Various Types of Welds, in Inches*



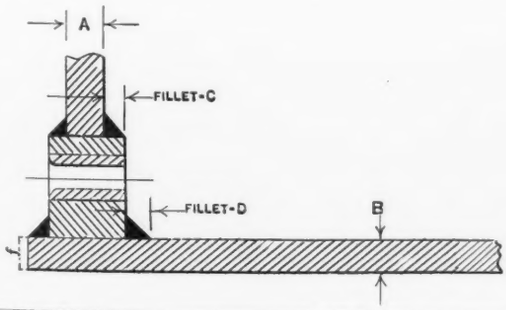
A	Fillet Size	Symbol	Rod Size
1/4 to 3/8	1/4	XX	5/32
7/16 to 1	3/8	XXX	3/16
1 1/16 and up	1/2	XXXX	3/16



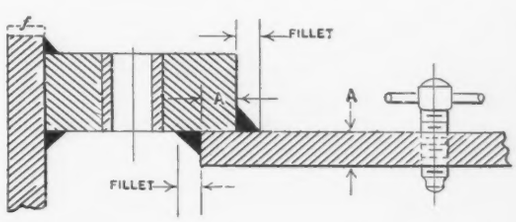
A	Fillet Size	Symbol	Rod Size
1/4 to 3/8 7/16 to 1/2	Same as Plate Thickness	One "X" for Each 1/8 Inch of Plate Thickness	5/32 3/16
.....			....



A	Fillet Size	Symbol	Rod Size
9/16 to 1 1 1/16 and up	3/8 1/2	XXX XXXX	3/16 3/16
.....	...	.....	....



A	C	Rod Size	Symbol	B	D	Rod Size
1/4 to 3/8	1/4	5/32	XX	1/4 to 3/8	1/4	5/32
7/16 to 1	3/8	3/16	XXX	7/16 to 1	3/8	3/16
1 1/16 and up	1/2	3/16	XXXX	1 1/16 and up	1/2	3/16



A	Fillet Size	Symbol	Rod Size
1/4 to 3/8	1/4	XX	5/32
7/16 to 1	3/8	XXX	3/16
1 1/16 and up	1/2	XXXX	3/16

*Fillet sizes are determined by the thinner of the two adjoining sections. Where extra strength is required, use heavier fillets. The allowable stress under shocks is 5000 pounds per square inch.

to the welding department. Several sheets of instructions have been drawn up which, in addition to supplying the workmen with information, have also standardized the manufacture of welded jigs and fixtures. The accompanying table shows various types of welds and sizes of beads or fillets used. A sheet showing the standard stock sizes of steel to be used is another convenience.

When a designer makes a drawing of a jig, he lays it out without showing any particular method of construction and then makes a separate sketch indicating the required welding and machining. The size of welding bead or fillet is indicated by employing symbols such as shown in the table. The material required for the job is given on the drawing. The total length of the different welds necessary to complete the jig is given for the convenience of the time-study supervisor, who estimates the time required to manufacture the jig.

Fig. 5. Spraying Oil-resisting Paint on Jigs

Detail Parts Cut out with Saws and Oxy-acetylene Torches

The parts required in the construction of jigs and fixtures are cut from bar stock by saws and from plates by means of oxy-acetylene cutting machines, such as shown in Fig. 1. Different types of these machines permit any shape or size of part to be cut that may be required. Fig. 2 shows a number of typical parts that have been cut out. It will be seen that all large holes are produced before the parts are assembled in a jig. Several small holes have been drilled in the biggest piece to facilitate the cutting out of larger openings.

Welding the Pieces Together

In assembling the various detail parts, they are first tack-welded sufficiently to hold them together. This work is done by a machinist to insure that the parts are properly located and squared up. Fig. 3 shows a jig tack-welded together and the use of a clamp for holding a tool-steel foot in place for tack-welding. A squaring or setting-up device is seen at the right.

After being tack-welded, the jig is passed to a welder who completes the welding. Fig. 4 shows a drill-jig body completely welded which, though approximately 23 inches long by 15 inches wide by 12 1/2 inches high, weighs only 120 pounds.

Since it is not possible to test a weld without destroying it, the welder must be relied upon for good workmanship. Each welder is required to stamp his work with a stencil; thus if the weld-

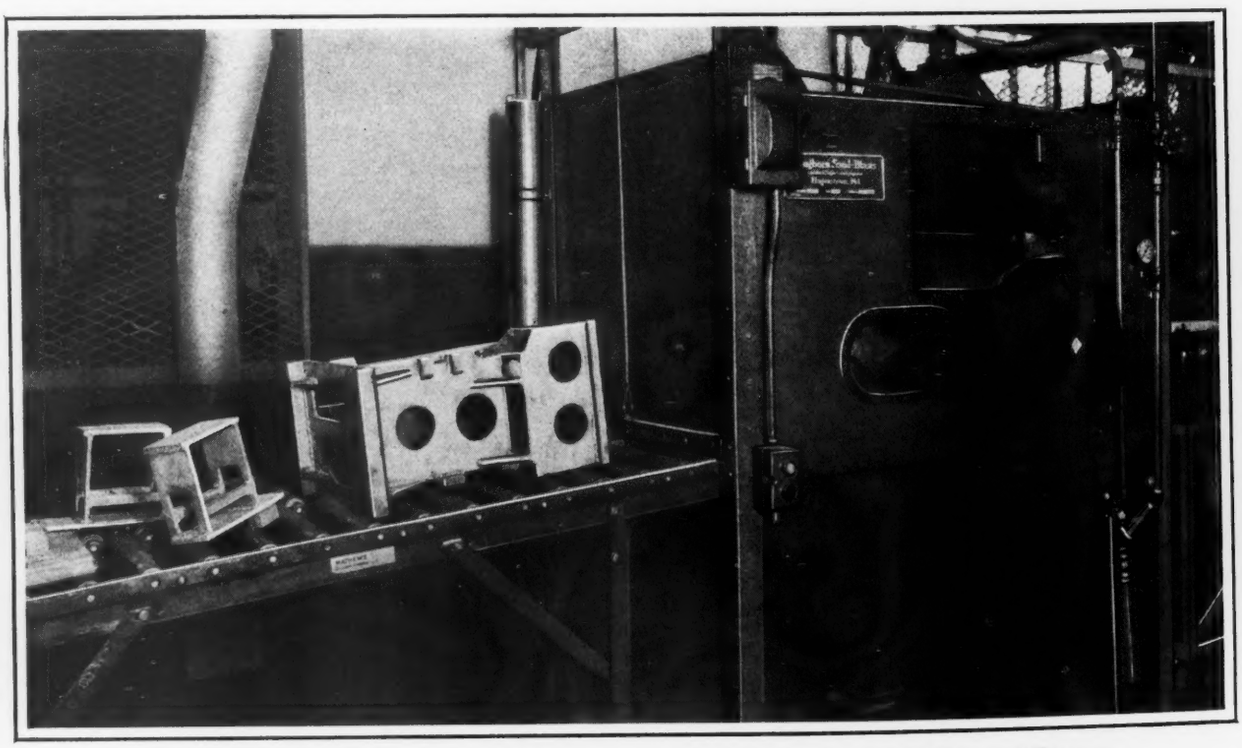


Fig. 6. Sand-blast Equipment Employed in Removing Scale from Arc-welded Jigs and Fixtures

ing of a jig or fixture proves unsatisfactory after the part has been placed in service, the faulty welding can be readily traced to the man who did it. Tests are run on welds periodically, and if unsatisfactory welding is discovered, the workman responsible for it is required to take additional instruction.

All Jigs Are Normalized, Sand-blasted and Painted

Certain strains resulting from the welding must be relieved so that the jig parts will maintain their shape and size. This is done by heating the jigs in a furnace to a temperature of 1000 degrees F. and allowing them to cool slowly in the air.

Owing to the use of hot-rolled steel and to the normalizing process, a certain amount of scale is left on the jigs, which must be removed. This is done by means of the sand-blast equipment shown in Fig. 6, which greatly improves the appearance of the jig parts.

After the sand-blasting operation, the jigs are sprayed with an oil-resisting paint, as shown in Fig. 5. They are then sent to the shop for machining. These operations are no different from those that would be required with a cast-iron jig except that less material is allowed for finishing.

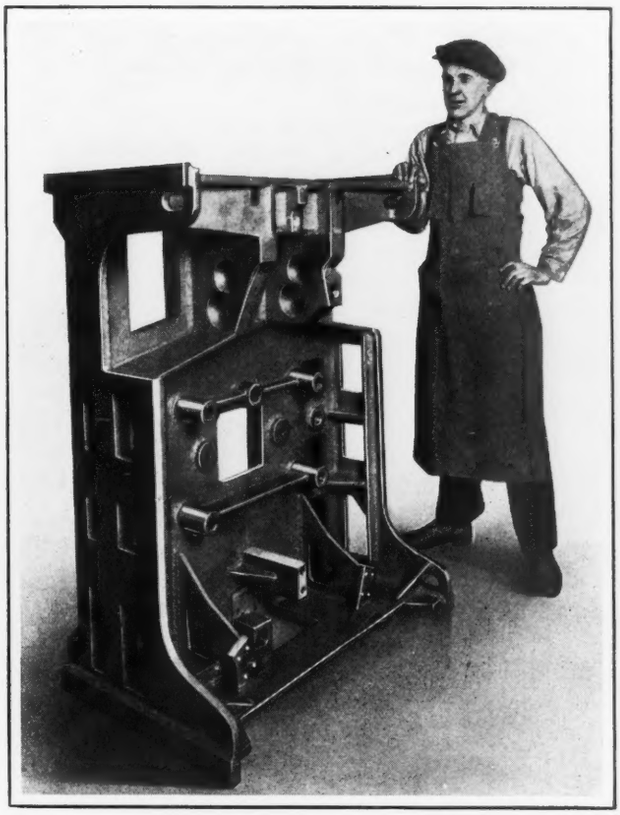


Fig. 7. Complicated Drill Jig Constructed Entirely by Arc-welding Steel Pieces Together

Fig. 7 illustrates a jig weighing approximately 1300 pounds, which has been built entirely of hot-rolled bar stock and plates. The over-all dimensions are 39 1/2 by 51 1/2 by 21 inches. The bosses are made from round stock, cut off with a saw and welded in place.

Cutting Machine of Arc-welded Construction

Various special machines such as are designed and built in the Westinghouse plant have been constructed in the same manner, a typical example being the double-head oxy-acetylene cutting machine shown in Fig. 8. This machine is so constructed that one man can operate both heads from one position. In operating this equipment, no trouble has been experienced from misalignment, vibration, or similar defects found in machines not properly constructed.

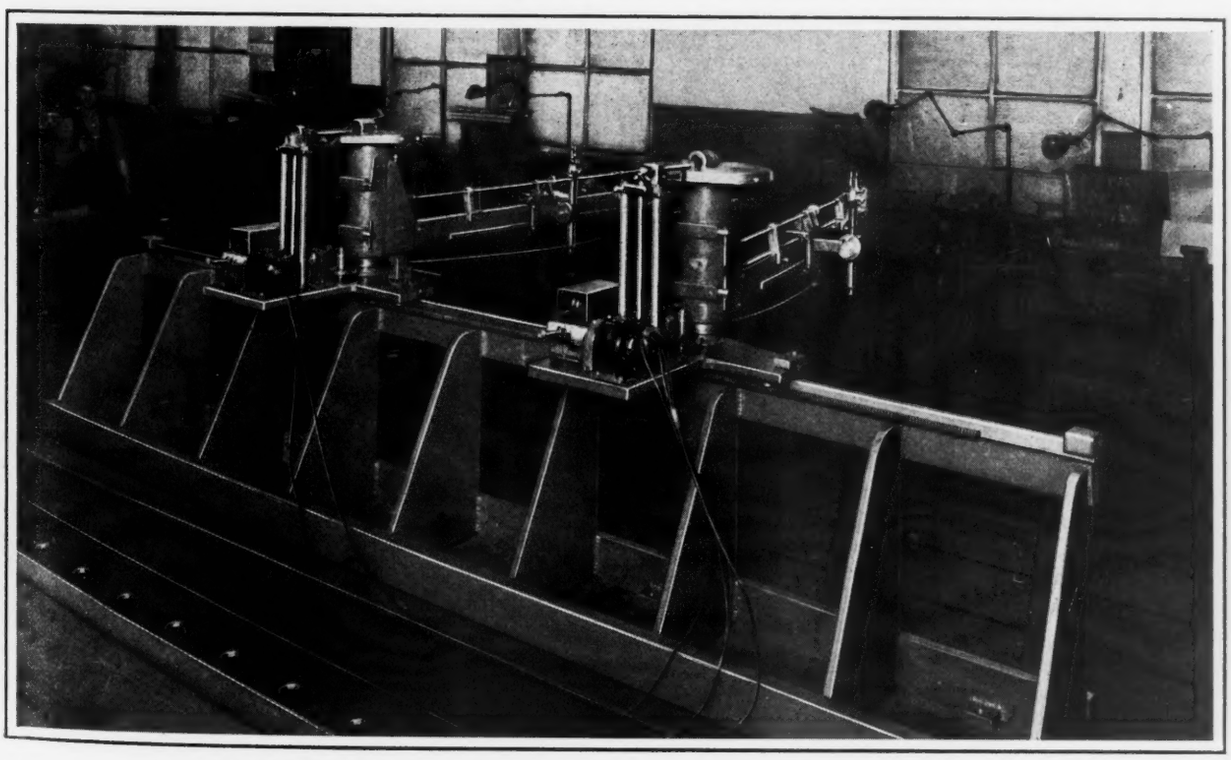


Fig. 8. Double-head Oxy-acetylene Cutting Machine with Arc-welded Frame

REPAIRING A LARGE CYLINDER BY ARC WELDING

In Fig. 1 is shown a 60-inch crack in the cylinder wall of a vertical blowing machine. This crack and a similar one on the opposite side of the cylinder were repaired by arc welding and the cylinder placed back in service within 325 hours. A new cylinder would have cost $12,000 and would not have been completed within nine months. Thus the equipment was repaired and put in operation in less than one-fifth of the time that would have been required to obtain a new cylinder. Also, the cost of repairing the cylinder by welding was less than 7 per cent of the cost of a new cylinder.

As the crack had opened or spread about 1/4 inch at the bottom, it was necessary to draw the sides together before starting the welding operation. This was done by shrinking rings alternately over the cylinder head bolts and over two bolts located in the outer edge of the cylinder rim. In order to keep the shrinkage strains at a minimum, the welding was done slowly, the operator depositing only about 1 pound of metal an hour.

The metal was deposited in zones by skipping from one section of the crack to another. These zones are clearly visible in the final string of metal which completed the weld, as shown in Fig. 3.

Fig. 2 shows the crack after it was beveled and prepared for welding by inserting threaded studs in two rows of holes which were drilled and tapped on each side of the crack. A shallow groove was cut between each of the double rows of plugs in order to facilitate the fusing of the welding metal with that of the cylinder. The studs are made of steel and serve as anchorages for the welded-on metal. The repaired part is further strengthened by means of a link which is welded in place over two pins inserted in the flange at the lower end of the cylinder.

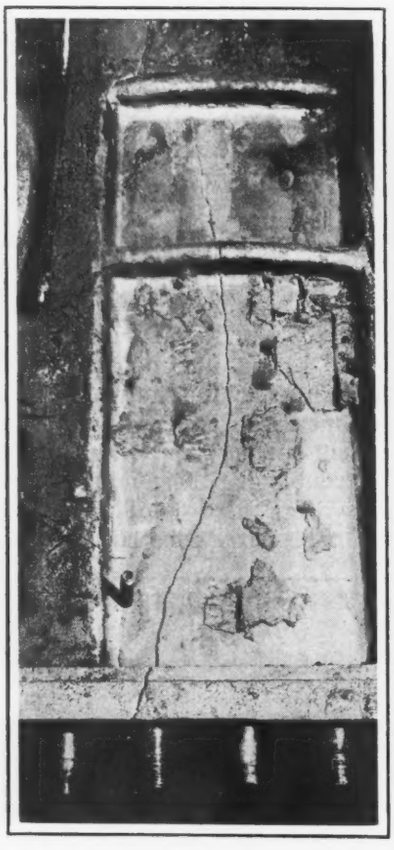


Fig. 1. View Showing Crack in Cylinder Wall of Blowing Machine

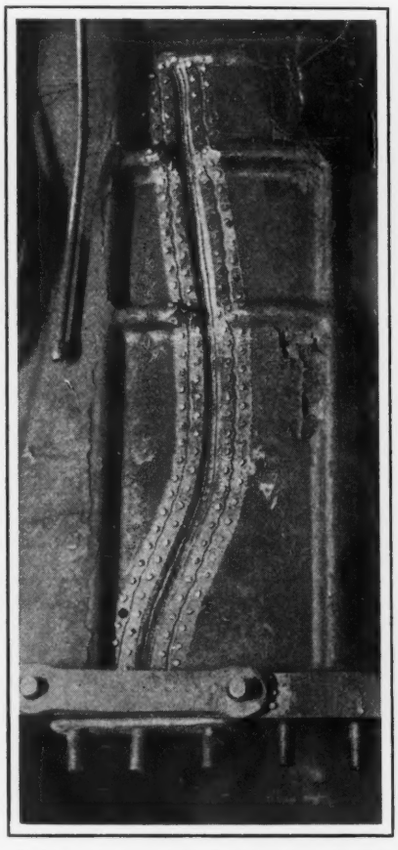


Fig. 2. Crack Shown in Fig. 1 Ready to be Repaired by Arc Welding

Fig. 3. View of Cylinder Wall after being Repaired by Arc Welding

* * *

BALL BEARINGS FOR AIRPLANE CONTROL SYSTEMS

Following the completion of a study of ball bearing applications to airplane control systems, undertaken in conjunction with both the Army and Navy air service and leading aircraft manufacturers, the Fafnir Bearing Co., New Britain, Conn., announces that it is in a position to produce a full line of ball bearings designed to fill the needs emphasized by this joint analysis. The object of the new line of bearings is to meet the demand for easier and more uniform operating controls, fewer repairs and replacements, less attention to greasing, and the elimination of jammed or "frozen" controls.

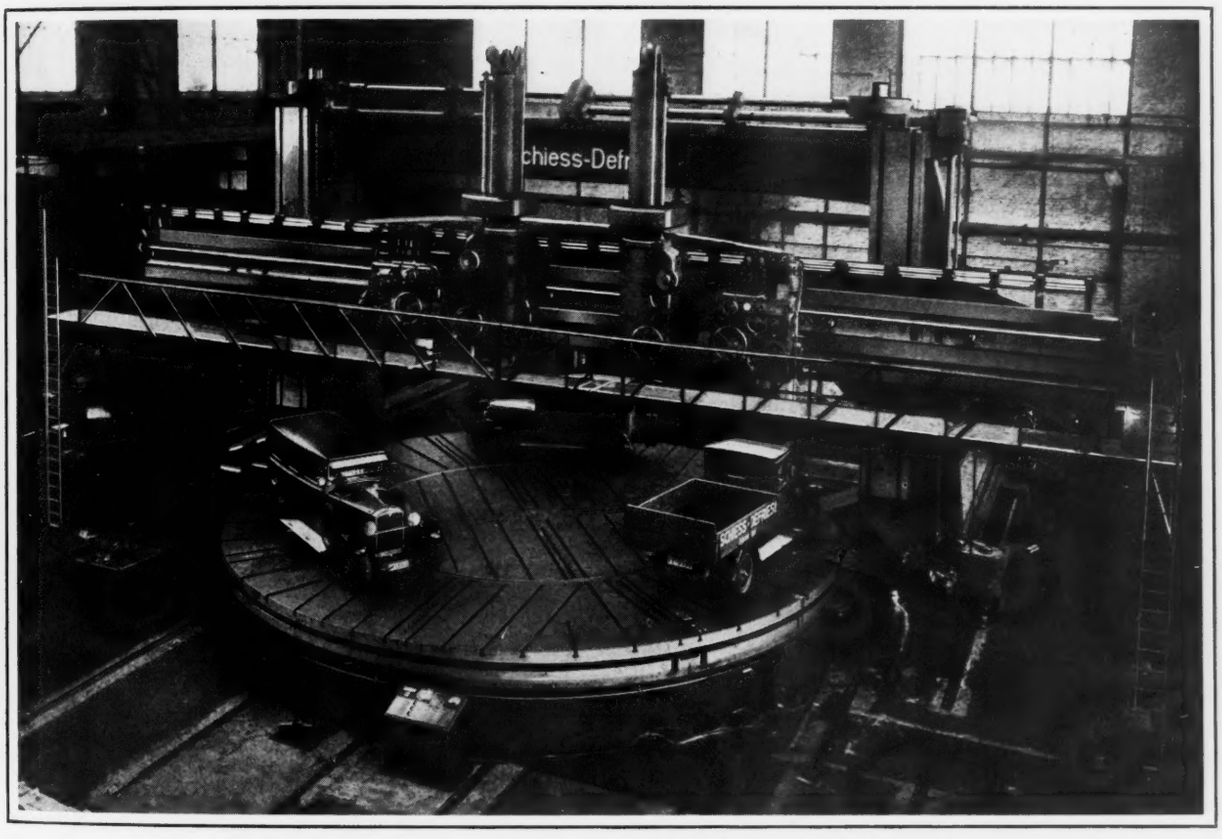
In addition to ball bearings for stabilizer adjustment mechanisms, rudder and brake pedal bars, steering wheels and sprockets, stick mechanisms, bellcranks, and other control devices, the company is producing ball bearing units for airplane wheels, designed for minimum friction with maximum loads on landing and tail wheels.

Mammoth Vertical Boring and Turning Mill

Machine Having Two Independent Tables and Adjustable Columns that Permit Work Up to 59 Feet in Diameter to be Turned

By S. WEIL, Chief Engineer, Schiess-Defries A. G., Dusseldorf, Germany

WORK weighing up to approximately 300 tons can be handled on a vertical boring and turning mill recently built by the Schiess-Defries A. G., for machining large parts of water turbines and similar equipment. The machine itself weighs about 700 tons. Twenty-seven railway cars were required to ship it to the customer, and special cars had to be provided for the largest parts, such as the columns, bed, cross-rail, and tables.



Boring and Turning Mill with 40-foot Table and Adjustable Columns, Capable of Turning Work 59 Feet in Diameter

One of the unusual features of the construction of this machine is the provision for turning parts up to 59 feet in diameter with the tool-heads, even though the table is only about 40 feet in diameter. This increased capacity has been made possible by designing the two columns so that they are movable on beds which extend back from the table. Both columns, together with the cross-rail, tool-heads and overhead tie-piece, can be readily positioned along the beds to suit the diameter of the work.

With the columns in a rear position, the tool-heads cannot reach to the center of the work, but it is intended that only large annular parts be machined with such a setting and not parts that must be bored in the center. Parts up to 16 feet 5 inches high can be accommodated.

Auxiliary Tool Column Available for Machining Work up to 74 Feet in Diameter

By removing the entire overhead structure, including the columns, cross-rail and tie-girder, and employing a portable auxiliary column equipped with tools, work up to 74 feet in diameter can be machined. For turning outside surfaces, this auxiliary column is held stationary on a base on the outside of the work and the operation is performed by revolving the work to be finished past the tools on the column.

Inside turning is accomplished by mounting the auxiliary column on one of the two independent machine tables and revolving it around the inside of the stationary work.

Two Independently Rotating Tables

Another important feature of the machine lies in the table construction. There is a central table

with an annular or ring table surrounding it. Either of these tables can be revolved while the other remains stationary, or they can be rotated together. While work on the central table is being revolved past tools mounted on the tool-heads, work to be machined subsequently may be arranged on the outer table.

When large castings mounted on the outer table are being finished, the operator can stand on the stationary central table and conveniently observe the cuts. Both tables are driven as one unit for machining large parts that have a central bore to be finished as well as circumferential surfaces. The central table measures 21 feet 4 inches in diameter, and the ring table, as mentioned, about 40 feet.

Surfaces can be turned with various amounts of taper through the medium of change-gears provided on the tool-heads. The left-hand head can be operated similarly to the ram of a slotting machine for cutting grooves. Either head can be fitted with a special attachment for driving a boring-bar held in the head spindle and guided in the center of the table. The cross-rail is designed to receive a milling head.

Arrangement of the Controls

Easy operation of this huge machine has been assured through the provision of a push-button control for starting and stopping the motors. In addition, each tool-head is fitted with a push-button switchboard and an illuminated disk which shows by the position of an indicator line whether the tool is moving vertically or horizontally.

On account of the great length of the cross-rail, it would have been impractical to arrange control levers for the movements of the tool-heads at the ends of the cross-rail or on the columns. Therefore, feed-boxes have been connected direct to the tool-heads and a high-speed movement is effected by a vertical-type motor attached to each tool-slide. A platform extends the entire length of the cross-rail for the convenience of the operator.

Reducing Costs by Careful Design of Patterns

In a paper prepared by J. D. Judge, works engineer of the Hamilton Foundry & Machine Co., Hamilton, Ohio, for the Gray Iron Institute, the importance of properly designed and maintained patterns for the production of castings is emphasized. The buyer of castings is advised to make it a particular point at all times to discuss his casting problem with the foundry that is to produce his castings. Questions affecting the design of patterns that will reduce production costs can always be decided most satisfactorily by a conference between the casting buyer and the foundry.

The quality of a pattern has a decided influence on the quality of the resulting casting. The assumption that a good molder can make up for the deficiencies in a pattern is not based on broad experience. Quality is essential in pattern design and construction, for the simple reason that it bears a direct relationship to lower casting costs.

Some manufacturers, even in this age of quantity production, follow the short-sighted policy of using wooden patterns instead of metal equipment on production jobs. A small additional investment in the best kind of pattern for each kind of job pays a handsome return in reduced foundry costs.

The machine designer requires a broad general knowledge of practical foundry work as well as of machine shop practice. Often problems present themselves that necessitate the balancing of one set of conditions against another. A high degree of judgment is demanded of the designer under such circumstances. The design of thin sectional castings, such as bases, covers, hoods, boxes, and similar parts, afford good examples of this fact. In a casting of this type, the metal thickness is an important item, because it affects the total weight to a great extent.

Frequently it is found that two simple castings may be more economical to produce than a single complex one. This is true even when consideration is given to the additional machining, grinding, or other operations that may be necessary when two castings are used. A simple casting can be produced much more rapidly in the foundry by a less skilled type of labor. Frequently the simpler castings can also be handled more easily in the machine shop.

The spacing of patterns, when a number of small patterns are combined to form a mold, is an item of considerable importance. Patternmakers who have been accustomed to working with heavy sections are often too liberal with the space that they allow between small patterns. Spacing, arrangement, and gating are all factors which affect the ultimate cost of the castings. They are all equally important, and no one factor should be disregarded.

* * *

METHODS OF APPRENTICE TRAINING

In a paper read before the American Management Association at its recent meeting in Cleveland, Byron F. Field, superintendent of training of the Commonwealth Edison Co., stated that, in investigating the apprentice training methods of 168 companies, it was found that in only three plants was the entire apprentice training given in a special training shop and school, while fifty-three companies combined a special school-room training with training in the regular production shop. He mentioned that there seems to be a tendency to support public trade schools for furnishing the classroom instruction rather than to maintain special schools or classes in the shop.

What MACHINERY'S Readers Think

A Department for the Interchange of Ideas on Problems of Management, Foremanship, and Employe Relations

THE FOREMAN'S JOB IN TRAINING NEW MEN

Referring to the article "The Foreman's Job in Breaking in New Men" in February MACHINERY, page 443, I wish to emphasize the thought that instruction is a very important part of the foreman's job. In fact, my experience in working with foremen reveals the fact that where a foreman is a good instructor, he is also a good departmental leader. Furthermore, the industries are becoming very much interested in knowing more about the training of men.

Assistant Supervisor, Foremen Conference Service, Ohio State Board for Vocational Education. R. W. JENKINS

TRAINING DRAFTING APPRENTICES

While there are quite a number of plants that train shop apprentices, the number that train drafting-room apprentices in a systematic manner is comparatively small. One company, however, provides a two-year training course for draftsmen that has proved very successful. The course is divided into eight terms of three months each.

The boys work regularly in both the shop and the drafting-room, on such work as they can perform, and in addition, they have class periods of two hours' duration three times each week. During each term they have to complete ten specific problems in drawing, five of which are done in the classroom and five at home. The boys attend classes during working hours and receive their hourly rate. The practical training begins with the making of tracings and general drafting work; then follows work in the pattern-shop, foundry, machining, and assembling departments of the shop. The last six months of the course are spent in the drafting-room. One class period of two hours each month is spent on an inspection trip through some part of the shops.

A careful selection of the boys to be trained, together with careful supervision in the training course, has made of these apprentices enthusiastic, self-reliant, and resourceful draftsmen.

HARRY KAUFMAN

DEVELOPING DESIGNS THROUGH CONSULTATION

A method by which a large manufacturing concern has saved a great deal in manufacturing costs may be of interest to the readers of MACHINERY. Whenever a draftsman designs an intricate part, say a large casting, and before he goes too far into the design and completes his drawing, he consults with the men who will be responsible for the production of the part being designed.

The foremen of the pattern shop, the foundry, and the machining departments, and any other men who will be responsible for the making of the part, are brought together for the purpose of looking over the preliminary lay-out. These men are able through their experience, to offer suggestions that will eliminate unnecessary operations in the shop. The foreman of the pattern shop, for example, may see a method of changing the drawing slightly so that he can save many hours of labor.

It is understood, of course, that in no case will changes be made if engineering features would thereby have to be sacrificed. The idea is to obtain just as good a design but one that can be manufactured more cheaply. It is believed that this plan might be followed profitably by many concerns.

MORTON SCHWAM

TOOL KITS FOR SERVICE WORK

The editorial in a recent number of MACHINERY on the importance of improving tool kits for service work is one that executives having service men on road would do well to consider. In addition to reducing the weight of tools through proper design without impairing their strength or efficiency, there are also possibilities in this direction by substituting alloy steels, aluminum, and light weight alloys, for certain parts of these tools.

Fine tools used in service work, such as micrometers, speed indicators, and gages should be kept in light-weight metal cases, velvet lined, as these delicate tools are likely to become damaged if carried without protection among other tools in the tool kit.

Tool kits for service work should be inspected periodically with a view to seeing that all the tools are in good condition. This precaution will not only prevent delay due to broken tools, but will also prevent accidents. Defective hand tools are responsible for many accidents. A. EYLES

* * *

According to the National Automobile Chamber of Commerce, 366 Madison Ave., New York City, the shipments of automobiles and trucks, parts, tires, gasoline, oil, and materials used in automobile manufacture, together with stone and gravel used for highway construction, constitute 12 1/2 per cent of the carload freight revenues of American railroads. The total amount paid for transporting freight of this kind exceeds $540,000,000 annually.

Handling Materials by Modern Methods

Important Developments in the Efficient Handling and Transporting of Materials and Work in Progress in Machine Shops

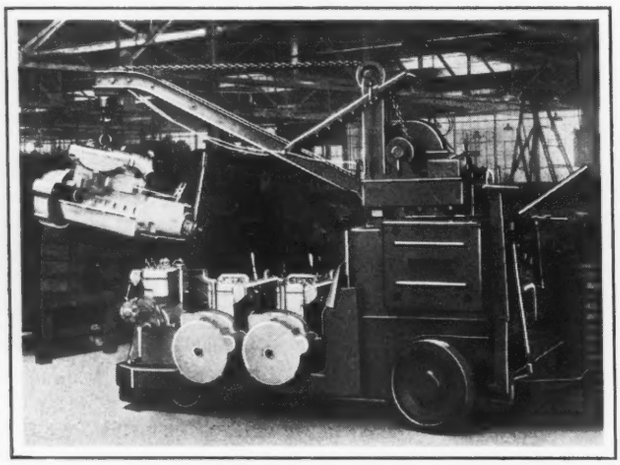


Fig. 1. 6000-pound Low-platform, Low-lift Electric Industrial Truck with 1500-pound Capacity Crane

A REPORT on progress in materials handling, prepared by the Materials Handling Division of the American Society of Mechanical Engineers, records the progress that has been made in materials handling during the past year. The parts of this report that apply especially to the handling and transporting of materials and work in progress in machine shops are abstracted in the present article. It is evident, as stated in the report, that it is impossible to measure accurately the progress that has been made in materials handling during the past year: First, because it is impossible to obtain complete data; and second, because there is no real yardstick by which this progress can be measured. Nevertheless, the manufacturers of materials handling equipment have made real progress and in several cases are doing special research work.

Cooperation between Builders and Users of Material-handling Equipment

While most manufacturers of materials-handling equipment are conducting their own experiments, much is also being done through the cooperation and assistance of users. For example, a certain industry will present a problem to a manufacturing company and will agree to cooperate in the working out of the materials handling problem. The job is then built with the understanding that it will take some time to get the various problems solved. This has been particularly true in the automobile industry.

Research work is being done to some extent, in colleges and testing laboratories, along the lines of heat-resisting alloys for materials-handling apparatus passing through ovens at high temperatures, heat-resisting bearings, and the effect of combinations of water and heat. Lubrication problems, which are very important factors, are being given a great deal of study by both the conveyor manufacturers and the lubricating companies.

Manufacturers of materials-handling equipment report increasing interest on the part of industry in general, stating that they are now frequently consulted when plans for changes or additions are in very early stages, so that the scheme under consideration may be developed with particular reference to proper materials handling. They report also that the increased output per unit of machinery has been a big factor in making proper handling methods a necessity. Another important development seems to be the fact that the average manufacturer now has generally gotten away from the thought that his product could not be handled on chains or conveyors because it was "entirely different."

Some Types of Trucks

Fig. 1 shows a 6000-pound low-platform, low-lift electric industrial truck on which is mounted a crane having a capacity of 1500 pounds. This truck is primarily a low-lift skid-carrying truck with a platform lift of 4 1/2 inches. The truck is shown

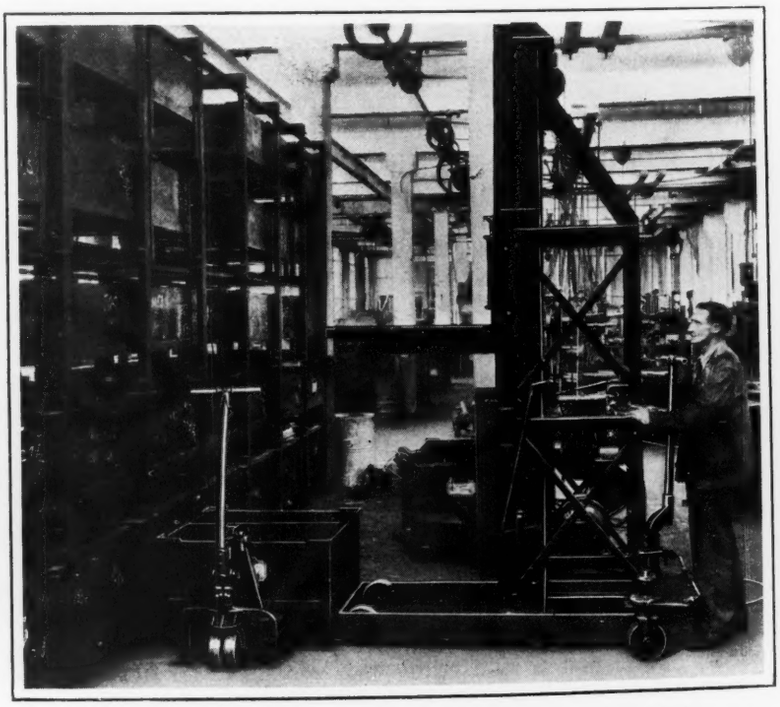


Fig. 2. Electrically Operated Stacker for Storing Box Skids

with its own platform loaded, having been loaded by the crane, and an additional load on the crane hook. The articles shown being transported are marine engines; it was not found necessary by the user to make use of skids in the transportation of this material.

A truck has been brought out, the battery of which is mounted above the deck directly over the front wheels next to the dash. In this position, it acts as a counterweight for the overhung loads for which this machine was designed, that is, cranes with extensible topping-lift booms, and for the vertical elevating mechanism on which can be mounted shovels, crane arms, rams, stacking tables, and devices for stacking both cylindrical and rectangular pieces. The mounting of these various devices is such that they can be interchanged in a couple of minutes. These trucks are made in three sizes, having wheel-bases of 36, 48, and 60 inches in length. When equipped with a telescopic topping-lift boom, there are two power units mounted over the battery, one for raising the boom and the other for hoisting the hook. Thus equipped, they will handle 3600, 4800, and 6000 pounds at high speed over ordinary street pavements or on cinder-filled yard areas.

A similar elevating mechanism has also been brought out in the form of an attachment to a jack-lift truck which has been made for years. This attachment is automatically locked to the frame of the truck, and then the jacks raise the attachment to the operating position.

Advantages of the Foot-lift Truck

A new truck has been developed that is known as the foot-lift truck. This truck enables the operator to elevate the load by using the full weight of his body, rather than calling into play his back and stomach muscles, which are used when the load is elevated with the steering handle. The foot-pedal is so designed that it automatically engages the load-elevating means when depressed, and automatically disengages when it is returned to the normal operating position. The room required to operate this truck is much less than with any other type, as it is necessary only to provide sufficient space for the operator to stand in front of the truck, whereas with the handle type, it is necessary to have aisle room to bring the handle practically to the floor in raising the load.

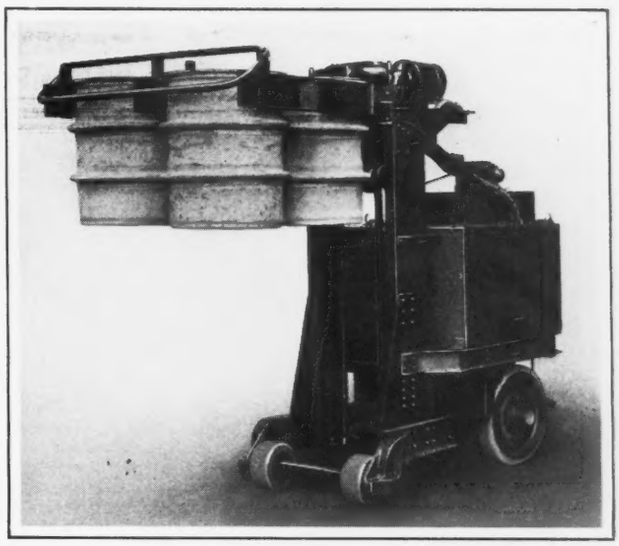


Fig. 3. Special Truck for Handling Steel Drums

When standard box skids are used for handling work in progress by means of a jack-lift truck, the "Jack-Rack-Stack" system shown in Fig. 2 has been used successfully. For storage, they are racked with the electrically operated stacker shown in the illustration. Units weighing from 1000 to 2000 pounds are easily handled in this way by one operator. A saving of space is at once apparent, as the five tiers of skid boxes are handled from a single aisle.

Fig. 3 shows a recently designed truck for handling steel drums. The drums are loaded in box cars by this machine and are taken out of cars and stored two high in the warehouse. There has been a great saving in labor through the use of this particular truck, as the drums illustrated are filled with a paste used for making storage-battery plates, and consequently are very heavy. Formerly one man handled one drum at a time, while the new truck is built to handle four drums at three times the speed of the man with the hand truck.

Fig. 4. Light Gantry Crane for Machine Shop Use

A Gantry Crane for Shop Use

Fig. 4 shows what has been developed within the past year in the

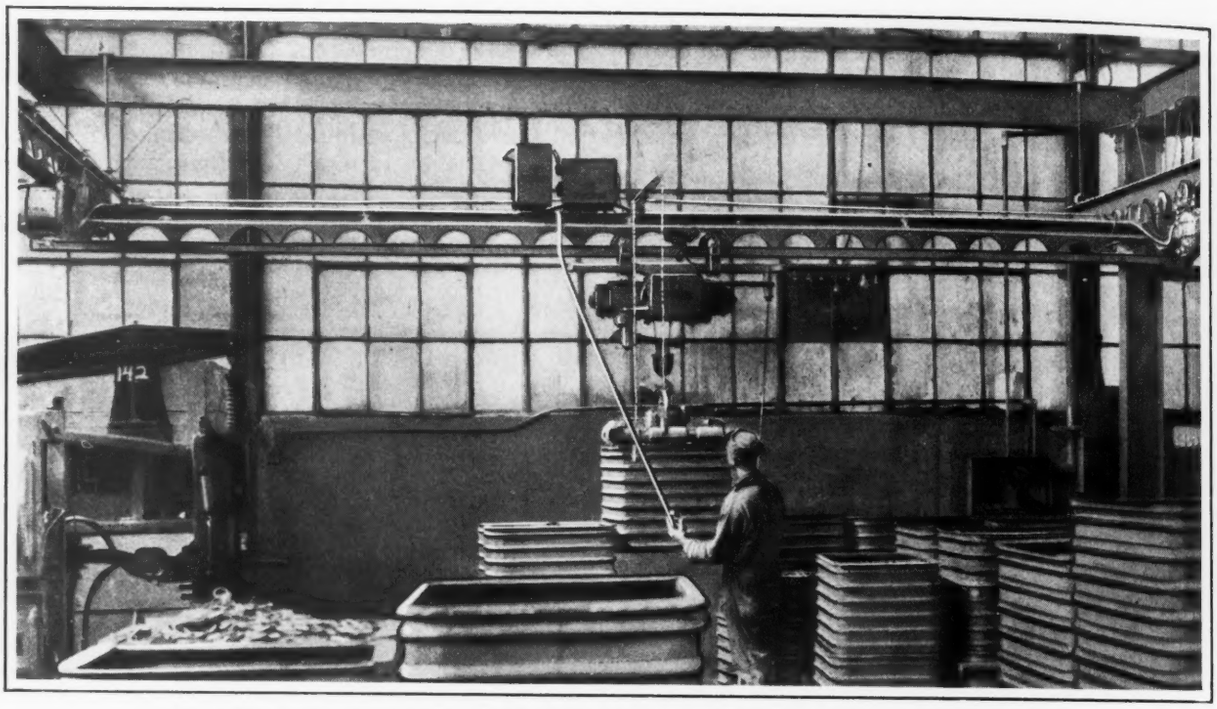


Fig. 5. Power-operated Transfer Bridge which Permits Moving the Hoist off Either End

way of a gantry crane which can be moved with ease sufficient to warrant its use in a great many machine shops throughout the country. This crane has ball bearings on both the lower leg and on the overhead half, and is so light that one- or two-ton loads can be picked up by the electric hoist at any point on the crane, and the entire crane moved by pushing on the load.

Fig. 5 shows a power-operated transfer bridge which is the result of several years of experiment in an effort to develop a transfer bridge that will lock at both ends with discharge points, and permit the hoist to move off one or both ends, as the case may be. The development of the multi-runway type of crane should be mentioned. The advantage of the three runways lies in the fact that by dividing the span of the crane in three sections, a much lighter crane can be furnished for a given load, with the result that the weight of the crane is reduced to a minimum. This reduction is a decided advantage in connection with the use of hand propulsion, because there is less dead weight to handle. The lighter cranes also have a decided advantage from the standpoint of building construction, because, with the use of the three-runway or multi-runway type of crane, the weight of the crane itself usually does not exceed the load which it is designed to carry.

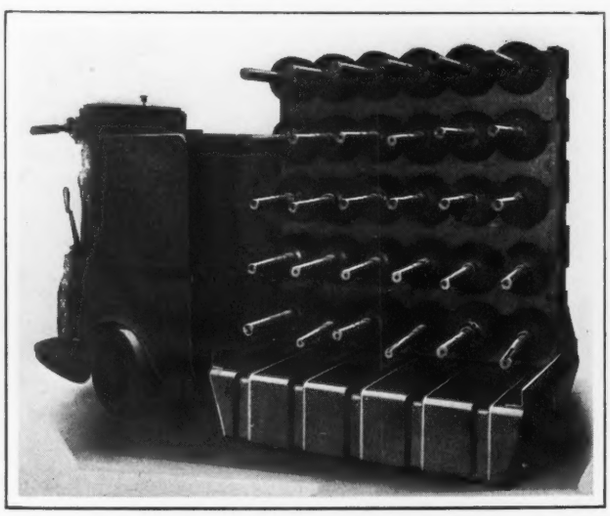


Fig. 6. Industrial-truck Skid with Specially Designed Rack for Handling Assembled Motor Rotors

Examples of Efficient Equipment

Another significant development in the metal-working field is the handling method adopted by the manufacturers of tinplate and sheet steel, who are loading this material into freight cars on standard skids by means of storage-battery industrial trucks, so that the recipient of these goods at the other end of the line can unload them from the same skids with the same type of truck and effect a tremendous saving in the handling cost.

A manufacturer of automobiles has adapted the fork-type truck to select bodies of the correct color to fit the specification of the chassis on the assembly line. Previously bodies have been taken from the conveyor horizontally, mechanically tilted on the cowl end, then revolved, picked up by a truck, and finally stood on end. The new method has reduced storage 66 per cent and has saved an investment of $250,000 which had been appropriated for a new storage warehouse.

A railway car and foundry company reports the recent development and installation of labor-saving devices, the most outstanding one being a "wheel breaker" used in breaking old wheels that are to be charged into cupolas at the foundry. These wheel breakers have now been developed to the point where they are

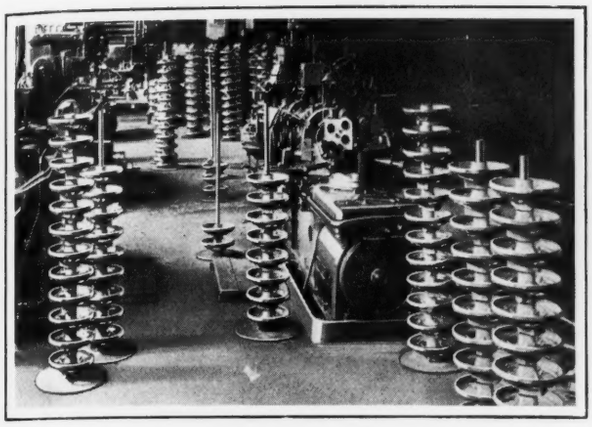


Fig. 7. Motor Brackets Handled on Vertical Spindles Between Machining Operations

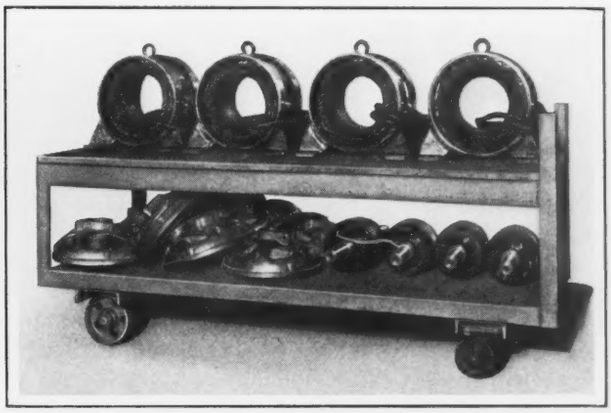


Fig. 8. Truck for Handling Complete Motor Parts from Storage to Assembly Line

practically automatic and have reduced the number of men required for this work from five to one, or at the most, two. The company is planning the installation of a chain conveyor for delivering the broken wheel sections from the breaker to the cupola charging platform. This step is expected to result in a further elimination of three more men.

New Materials-handling Methods in a Forge Shop

The materials-handling installation made at a motor car company's plant in Detroit in connection with a new forge shop for crankshafts is of interest in that it is among the first attempts to put forge shop production on a continuous basis. This development has been made possible largely through the medium of materials-handling equipment. The crankshaft forge shop is laid out for straight-line, continuous production, with no stock of parts at any operation. Travel of the metal from the original bar stock, through all processes, and finally into the railroad car for shipment is handled by various conveyor systems. There are five forging units, three heat-treating furnaces, and two pickling machines. This equipment handles 7500 crankshafts a day. The time required to convert bar stock into crankshafts, delivered at the shipping platform, is only 4 1/2 hours. In all, 225 men are employed in this new forge shop. The success of this development, and the reduction in total costs of forging it has brought about, open the way for the extension of the idea to other forged parts produced in quantity.

At another plant, in Toledo, Ohio, a materials-handling installation was made which has revolutionized the manufacture of transmissions and reduced the floor space required for the output to about one-third of the former area.

Methods in a Large Electrical Manufacturing Plant

Materials-handling developments at the plant of an electrical equipment manufacturer have been along the line of special equipment made to fit some certain job. This may or may not fit in with other standard materials-handling equipment, such as conveyors or industrial trucks. In attacking many of the problems in this plant, where so-called stand-

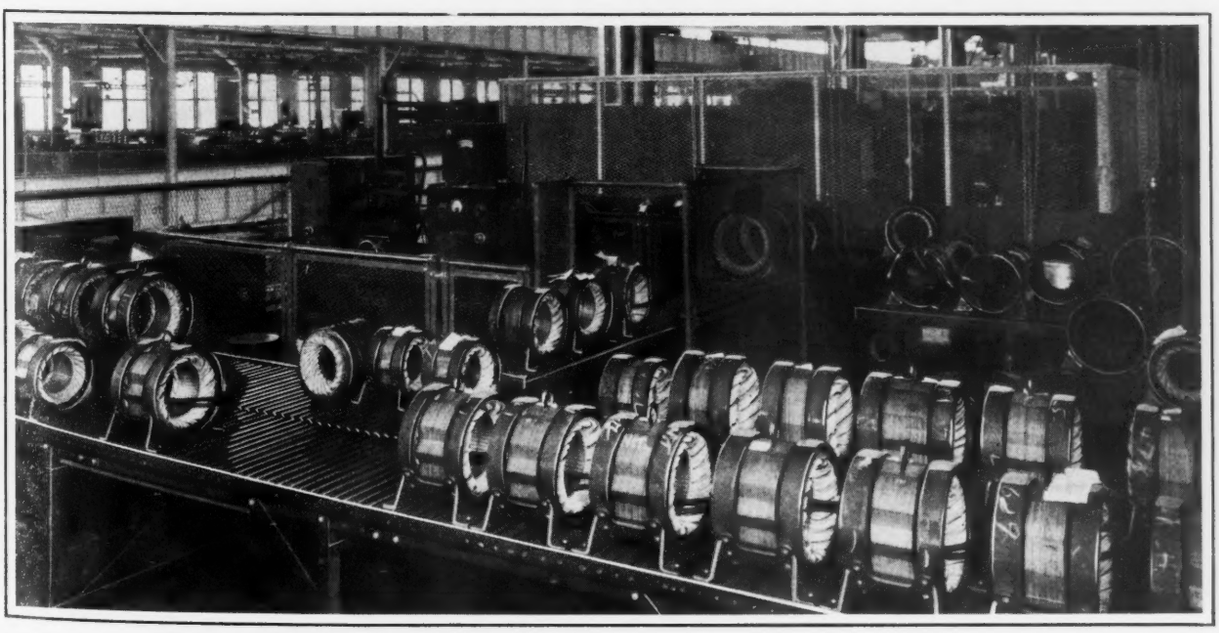


Fig. 9. Power-driven Conveyor Used in Testing Wound Motor Stators

ard methods of materials handling cannot be applied, careful study usually shows a method of meeting the problem which results in lessened handling costs. Industrial electric trucks are being applied to an increasing extent and with definite advantages on many lines of work. The flexibility of the truck is so great that it fits in excellently with the needs of such a plant, where the line of work varies from a small screw machine part to a generator as big as a house. By using the trucks as a motive power for industrial trailers in addition to their own pay load, the company has effected considerable economies, and has also taken care of peak-production loads without the addition of extra truck equipment.

Motor brackets are handled on spindles between operations performed on automatic machines, as shown in Fig. 7. These occupy little floor space and may be adapted for quick handling by means of chain conveyors.

The adaptation of an industrial-truck skid with a specially designed rack for handling assembled motor rotors is shown in Fig. 6. This method keeps the rotors clean and free from damage and allows bulk handling to and from storage. Fig. 8 shows a truck handling a number of complete motor parts which are taken from storage and conveyed to the assembly line. From the truck they are placed on a power conveyor where the final assembling and testing are accomplished. A power-driven conveyor used in the testing of wound motor stators is shown in Fig. 9.

The Department of Commerce reports that the skid method of shipment has continued to grow, as well as the use of various types of containers for rail and water shipping. In some cases, skid shipment has shown a remarkable saving, one plant reporting a reduction in labor costs of 90 per cent.

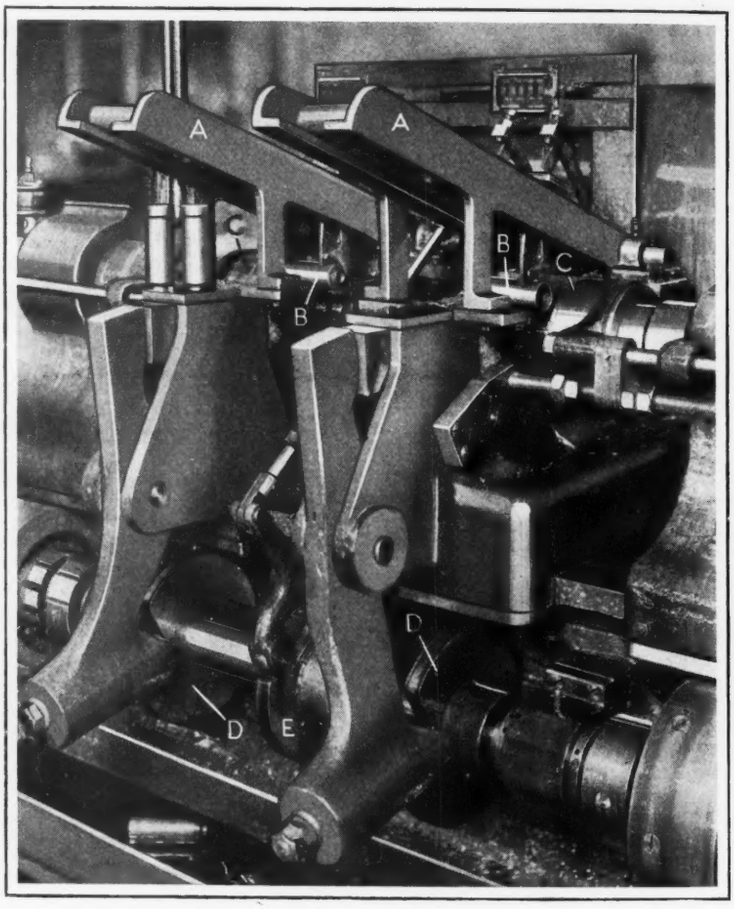
* * *

The shipments of electric refrigerators to Great Britain from the United States has increased from $214,297 in 1928 to $918,731 in the first eight months of 1929.

THREADING TWO TUBES AT A TIME AUTOMATICALLY

Threads 1 1/2 inches in diameter are cut simultaneously on two tubes in the shop of the Alemite Corporation, Chicago, Ill., by using the automatic double-end machine here illustrated. The average production on this job is approximately 740 tubes per hour, the threads being cut to a length of 7/16 inch.

A girl operator merely loads the tubes, which are used as bodies for lubricator compressors, into two chutes *A*. The tubes roll down these chutes until they reach swiveling mechanisms that transfer the tubes intermittently to the jaws in which they are held for the threading operation. The two tubes at *B* are shown at the point where they have been almost lowered into line with the jaws.



Machine for Automatically Threading Two Tubes at the Same Time

One jaw of each pair is stationary, while the other slides forward to grip the work and backward to release it. As soon as the two tubes are gripped, the transfer mechanisms move upward and the self-opening die-heads *C* advance to cut the threads. When the operation is completed, the die-heads recede at a fast rate, the movable jaws open, the work-pieces drop down through the machine, and the work-transferring mechanisms carry new tubes to the jaws.

All these movements are controlled by cams mounted on a shaft running along the front of the machine as illustrated. Cams *D* govern the operation of the movable jaws, cam *E* controls the movements of the work-transferring mechanisms, and drum cams on the same shaft move the headstocks on which the threading die-heads are mounted, to and fro as required.

* * *

During the first nine months of 1929, the exports of agricultural implements from the United States totaled $109,723,500. This represents a gain of nearly $20,000,000 over the exports for the corresponding period in 1928.

Letters on Practical Subjects

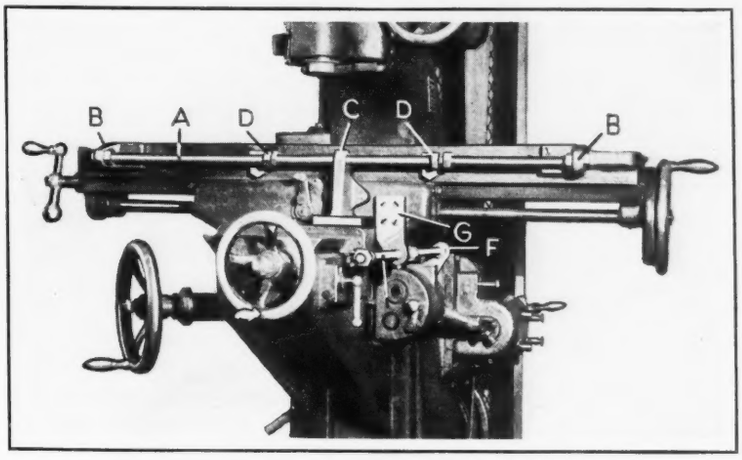
SPECIAL TABLE STOPS FOR MILLING MACHINE

Special milling machine table stops for both longitudinal and transverse feeds are shown in the accompanying illustration. These stops were designed by the writer primarily to enable greater accuracy to be attained when milling certain aluminum frames. Formerly a high grade mechanic performed this work, but owing to the sturdy construction and reliability of the stops shown, less skill is now required to obtain accurate results. These stops have also been used to advantage on other work of similar nature, and have been found effective in laying out dies and jigs.

Referring to the illustration, the screw *A*, which is threaded over its entire length, is supported in clearance holes in brackets *B*, fastened securely to each end of the table. Hexagonal nuts on both sides of these brackets prevent the screw from moving in relation to the table. The bracket *C*, which is fastened to the machine apron, has a clearance hole through which the screw passes, and is spot-faced on both sides to a standard thickness to facilitate setting the stop-nuts *D*.

A similar stop is provided for the transverse feed, bracket *G* being fastened to the machine apron, and bracket *F*, fastened to the knee, holding the screw *O*. Because of the overhang, the screw is supported by the end of a set-screw which rides against the bottom of a groove in the screw *O*, keeping it properly centered in the clearance hole in the bracket *G*.

H. L. BURMEISTER
Cleveland, Ohio



Milling Machine Equipped with Special Table Stops of Extra Heavy Construction

TESTING FAN PULLEY HUBS FOR POROSITY

A fixture for testing fan pulleys hydraulically, to detect any porosity of the metal, is here illustrated (see next page). The pulleys are of cast iron, and before being tested, are machined to the shape indicated by the heavy dot-and-dash lines at *W*. If the metal in the hub is porous, it will allow the oil to work through and be thrown off when the fan pulley runs at high speed.

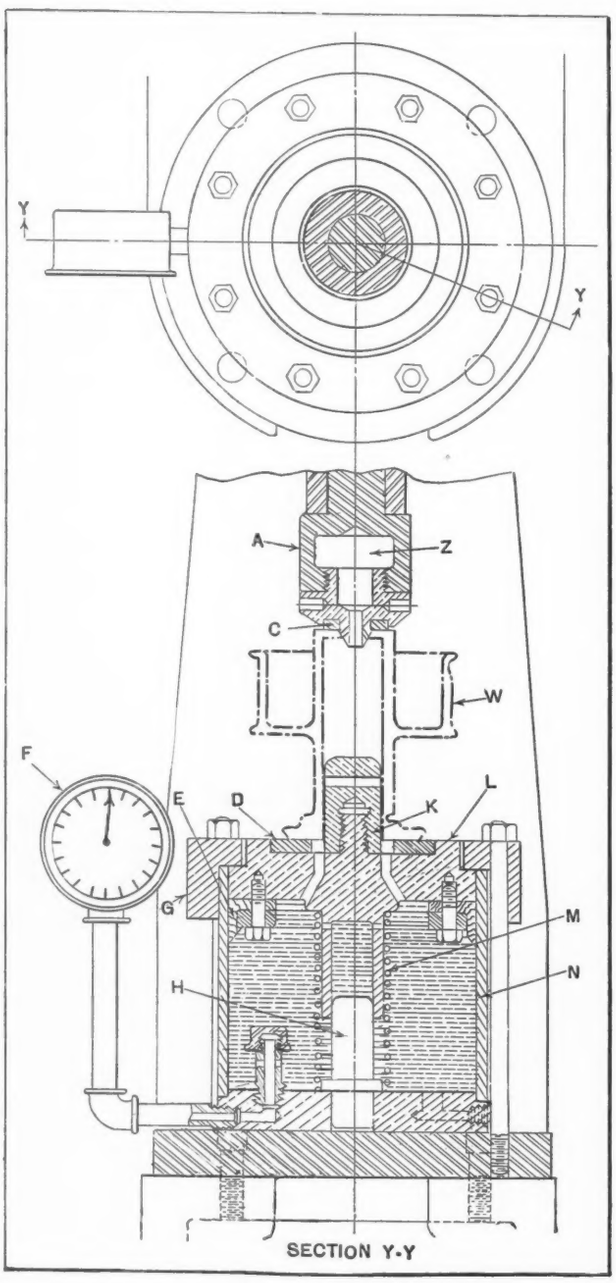
The fixture is mounted on a hand-operated press, the ram of which is bored out to fit the shank of member *A*. The ratio between the rack and pinion of the arbor press is approximately 7 to 1, and the operating handle is 36 inches long, so that a pull of 75 pounds at the end of the handle produces a pressure that is more than sufficient to meet requirements.

The pulley to be tested is placed over the pilot *K* on the piston and the ram of the press brought down upon the hub. The pulley and the piston *L* are forced downward, causing the water to flow through the holes in the piston and into the bore of the pulley. As the press ram, pulley, and piston continue to descend, the water rises in the pulley and compresses the air in the chamber *Z*.

When the bore of the pulley is completely filled with water, the downward movement of the ram is stopped and the pulley inspected for leaks. The compressed air in chamber *Z* exerts pressure on the water while the work is being inspected. The pressure registered by the gage *F* is usually from 50 to 60 pounds.

When the ram is raised, the compressed air forces all the water back into the cylinder.

The spring *M*, which resists the downward motion of the piston, keeps the pulley clamped securely between the two gaskets *C* and *D* on the upward movement and thus prevents leakage of water or air. After being tested, the pulleys are passed immediately through a drying oven. The fixture described is much faster and drier than the usual testing arrangement in which the local water supply is utilized to obtain the required pressure.



Fixture for Detecting Porosity in Hubs of Fan Pulleys

Referring to the construction of the testing device, the cylinder *N* is 6 inches in diameter and is made of brass tubing. It is held firmly to the base by a clamping ring *G*, secured in place by means of eight bolts. A gasket is placed between the cylinder and the base to prevent leakage. The piston *L* is machined from a bronze casting, and is a sliding fit over the stem *H*, which serves as a guide to prevent binding.

Formed "Vim" leather packing *E* is secured to the piston by a clamping ring and machine screws. About 1000 pounds is required to compress spring *M*. The pilot *K* is made about 1/16 inch smaller in diameter than the bore of the pulley in order to allow the water to flow around the hub. This pilot is removable, and can be replaced by other pilots to fit pulleys of different sizes.

Indianapolis, Ind. GEORGE L. PYRITZ

PRINTED FORMS FOR CORRECTING SHOP AND DRAFTING-ROOM ERRORS

Manufactured parts or units sometimes fail to function properly when assembled in the complete machine or product. The trouble may be due to errors in the drawings or specifications, or in the work performed in the shop. When trouble of this kind is encountered in large shops, the superintendent should request the shop inspector to obtain the information needed in making the necessary corrections. The inspector, in turn, must obtain the required information from the shop and the engineering department. This is done in a very efficient manner in one shop by using a printed form. The front side of the form is shown in the accompanying illustration. On the reverse side is given the following information:

This form for use in making requests for engineering information, shall be in duplicate, the original being printed on white paper and the duplicate on pink paper. The forms are numbered serially and made up in pads.

1. This form is to be used by the inspection department in procuring engineering information from the shops on parts or sub-assemblies falling under the following headings:

(a) Parts or sub-assemblies manufactured in accordance with detail drawings or specifications that will not fit on assembly.

(b) Parts or sub-assemblies manufactured in accordance with detail drawings or specifications that are believed to be weak in construction.

(c) Parts or sub-assemblies manufactured in accordance with detail drawings that will not function in accordance with specifications.

(d) Discrepancies in drawings or specifications.

(e) Changes in existing process specifications to expedite the manufacture of parts in accordance with practical shop methods.

2. In cases of material falling under the headings (a), (b), and (c), of paragraph 1, the inspector will tag the part with a rejection tag, and immediately make out a request for engineering information. This form will also be made out by the inspector to cover material falling under heading (d) of paragraph 1.

3. In cases where the shop superintendent desires a change in process specifications, in order to meet shop practices or to expedite production, he

No. 1085

REQUEST
FOR
ENGINEERING INFORMATION

Date.....

Project.....Foreman.....
Job Order No. .....
Schedule No. .....
Name.....Part No.....
Defects.....
.....

Inspector.....

Project Engineer's Instructions.....
.....
.....
.....
.....
.....
.....

Form for Submitting Requests for Engineering Information

will ask the inspector to submit a request for engineering information.

4. The forms shall be forwarded to the assistant chief engineer by the chief inspector; the assistant chief engineer, or his authorized representative, will have the necessary data entered on the forms and return the duplicate to the inspection office, issuing project slips if necessary.

The foregoing instructions explain the system quite thoroughly. With a system of this kind in use, many parts can be saved that might otherwise be rejected by the inspector. The duplicate copy, by calling the matter to the attention of the chief engineer, serves as a record of the inspector's authority for passing the part.

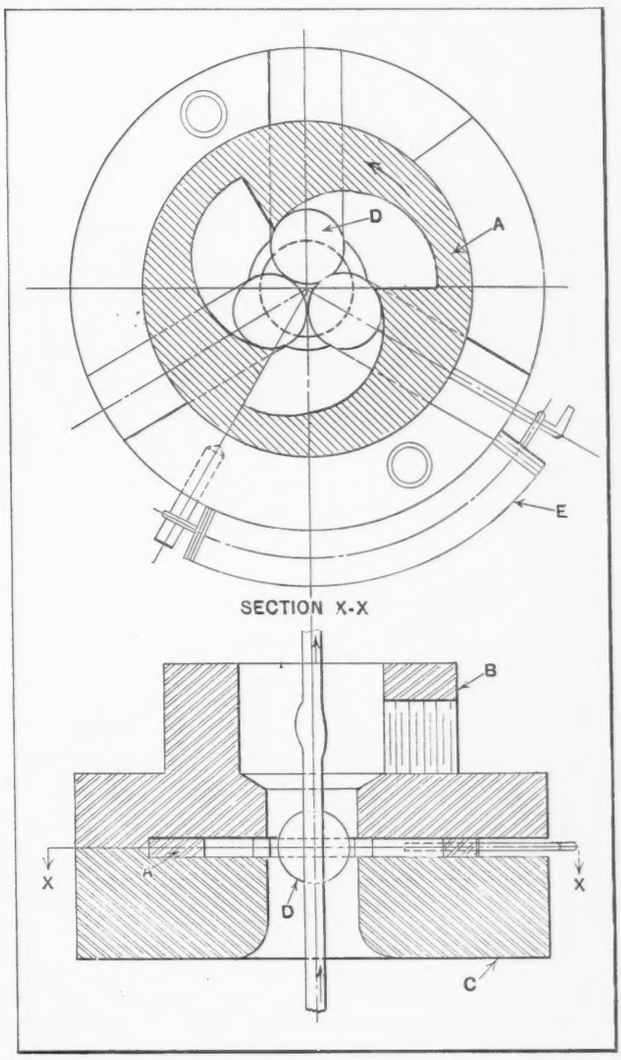
Philadelphia, Pa. MORTON SCHWAM

SELF-ADJUSTING CENTER GUIDE FOR WIRE-INSULATING MACHINES

The centering guide shown in the accompanying illustration was designed by the writer for use on a wire-insulating machine, but it can also be used on braiding and paper-taping machines as well as various other types of wire-working machines. In the case of the insulating machine, it is important that the centering device be so designed that it will keep the wire properly centered, and at the same time allow any irregular or enlarged portions to pass through without breaking or stretching the wire. The design shown is used for wire from 3/64 to 1/4 inch in diameter, and will allow knots or other irregularities to pass through without marring, breaking, or stretching the wire.

This mechanism consists primarily of a cam *A*, top and bottom cam-holders *B* and *C*, three hardened steel balls *D*, spring *E*, and two assembling screws. Cam *A* is free to turn between holders *B* and *C*. The tension exerted by spring *E* on cam *A* serves to hold the balls in the closed position. The balls thus form a three-point contact with the wire. An equal pressure is exerted by the balls.

When a knot or other irregularity in the wire, comes in contact with the balls, it exerts pressure on the balls which, in turn, is transmitted to cam *A*. This causes the cam to turn in the direction indicated by the arrow. Consequently, the space between the balls is enlarged equally at all three points, allowing the knot to pass through without deflecting the wire from its central position. The three equally spaced radial holes formed by the two members *B* and *C* are 1/4 inch in diameter and are drilled and reamed with the two parts assembled. The steel balls are close working fits in the radial holes. The spring *E* is made from 1/64-inch music wire, and has an outside diameter of 3/16 inch.



Wire-centering Guide which Allows Knots to Pass through

The proper tension on cam *A* is obtained by adjusting the length of this spring.

West Somerville, Mass. WALTER F. PRIEST

PUNCHING TAPER HOLES TO AVOID COUNTERSINKING

A die that has proved satisfactory for punching operations on stock having a thickness slightly greater than the diameter of the holes produced is shown in Fig. 1. This particular die performs the rather unusual operation of piercing three tapering holes in the automobile door latch shown at *A*, Fig. 2. The holes are for rivets 5/32 inch in

diameter, and it was first planned to countersink them after piercing, by employing a regular 90-degree countersink in a drill press. This would, of course, have been a slow and expensive job.

After some experimenting, it was decided that a sufficient taper or countersink could be obtained by allowing excessive clearance between the punch and the hole in the die. In this case, it was found that a clearance of nearly 1/16 inch could be allowed without developing objectionable burrs on the work. In actual practice, the assembly, as shown at *B*, Fig. 2, was found to be more secure when the rivets were upset in the rough-punched tapering holes than when upset in regular countersunk holes.

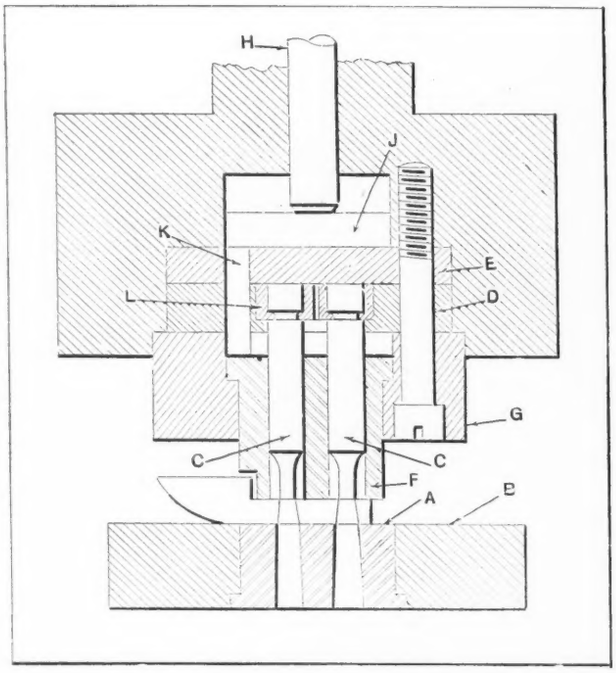


Fig. 1. Die Used in Punching Tapered Holes

The cross-section view, Fig. 1, is taken through two of the three punches and punch-holders. The die *A* is made in the form of a round button, and is mounted in the soft steel plate *B* to which is attached a nest (not shown) for locating the work. The three punches are held in plate *D* by hardened split collars *L*. An enlarged view of one of these collars is shown at *L*, Fig. 2. The annular bead or shoulder on the split sections of the collar fits into a turned groove in the upper end of the punch, as shown at *M*, so that when the members are assembled as in Fig. 1, the punch will be held securely in place.

A somewhat similar method of holding the punch, which is employed by a large concern engaged in the manufacture of automobile accessories and automobile bodies, is shown at *N*, Fig. 2. In this case, a groove is turned in the punch, the same as illustrated at *M*, but instead of the split collar, a single coil of spring wire *S* is used to prevent the punch from being withdrawn from the holder.

Referring to Fig. 1, the punches are backed up by the hardened plate *E*. The bodies of the punches *C* are ground and passed through lapped holes in the hardened guide member *F*, which, in turn, is a close sliding fit in the hardened and ground ring *G*. The work is stripped from the punches by means of the knock-out rod *H* acting against the pad *J*, which is in contact with three evenly spaced knock-out pins *K*.

The construction of the die is such that the punches are supported for nearly their entire length. Although not shown by the illustration, the die is of the pillar type, and altogether, is of an exceptionally rigid design. The ends of the rivets *D*, Fig. 2, are headed or upset in the tapered holes by means of upsetting punches.

Nutley, N. J. D. A. BAKER.

CHART FOR DETERMINING BLANKING PRESSURES FOR MILD STEEL

The accompanying chart provides a simple means for determining the pressure required for operating a blanking or piercing die. It was developed primarily to assist the foreman in assign-

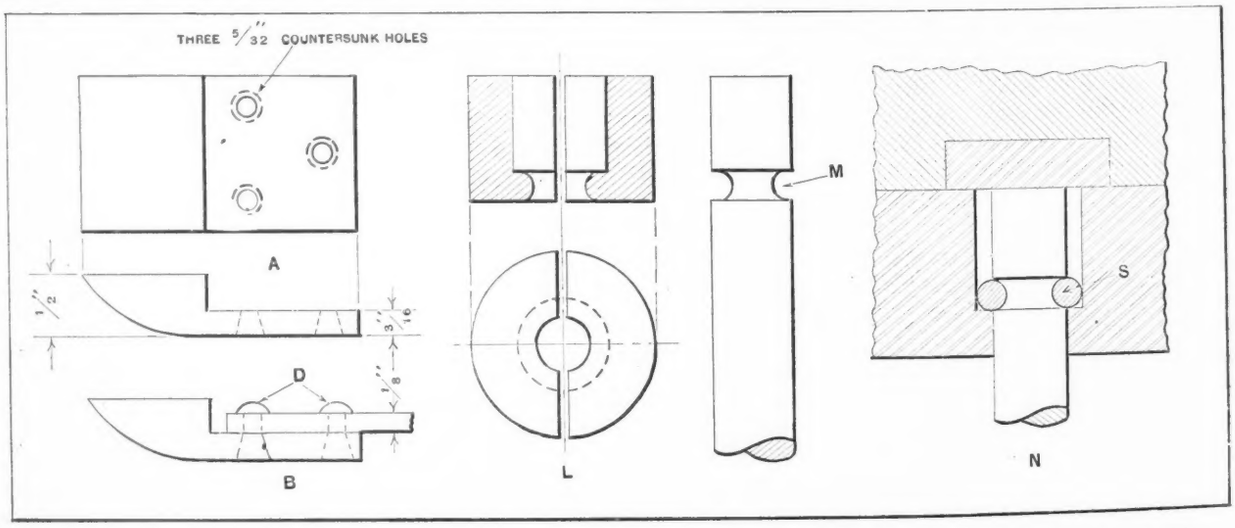


Fig. 2. (A) Part with Punched Tapered Holes; (B) Riveted Assembly; (L) Split Collar Used to Hold Punch M in Place; (N) Diagram Showing Another Method of Retaining Punch in Holder

ing dies to presses having sufficient capacity to avoid breakage. In the plant where this chart was devised, the maximum capacity of each press was painted in large white letters on the frame in some conspicuous position. Thus, with the chart for determining the pressure required to operate the die, and with the maximum working pressure of the press definitely known, breakage due to overloading was practically eliminated.

In determining the pressure, in tons, required to operate a blanking or piercing die, simply locate the diameter at the bottom of the chart and follow the vertical line upward to the point where it intersects the horizontal line corresponding to the thickness of the material. The diagonal line nearest this point is the pressure required. For example, if the blank were 5 inches in diameter and the stock 0.250 inch thick, the blanking pressure would be 100 tons.

The values given in the chart are based on the assumption that the material has a shearing strength of 50,000 pounds per square inch and that the blanking die has no shear. If the punch is ground with a shear, the pressure required will be approximately one-fifth less than that given. The formula on which the chart is based is:

$$P = D \times \pi \times t \times A$$

in which

P = blanking pressure, in tons;
D = diameter of blank, in inches;
π = 3.1416;
t = thickness of stock, in inches; and
A = ultimate shearing strength, in pounds per square inch.

It will be noted that there are two constants in the equation, namely, π and A. In this case A, being for mild steel, is taken as 50,000 pounds per square inch. As ordinarily plotted, the line obtained by the use of this equation would be curved, but instead of using equally spaced ordinates and mantissas, these lines are spaced according to the well-known principle of logarithmic divisions, so that the tonnage is expressed by straight lines instead of curves.

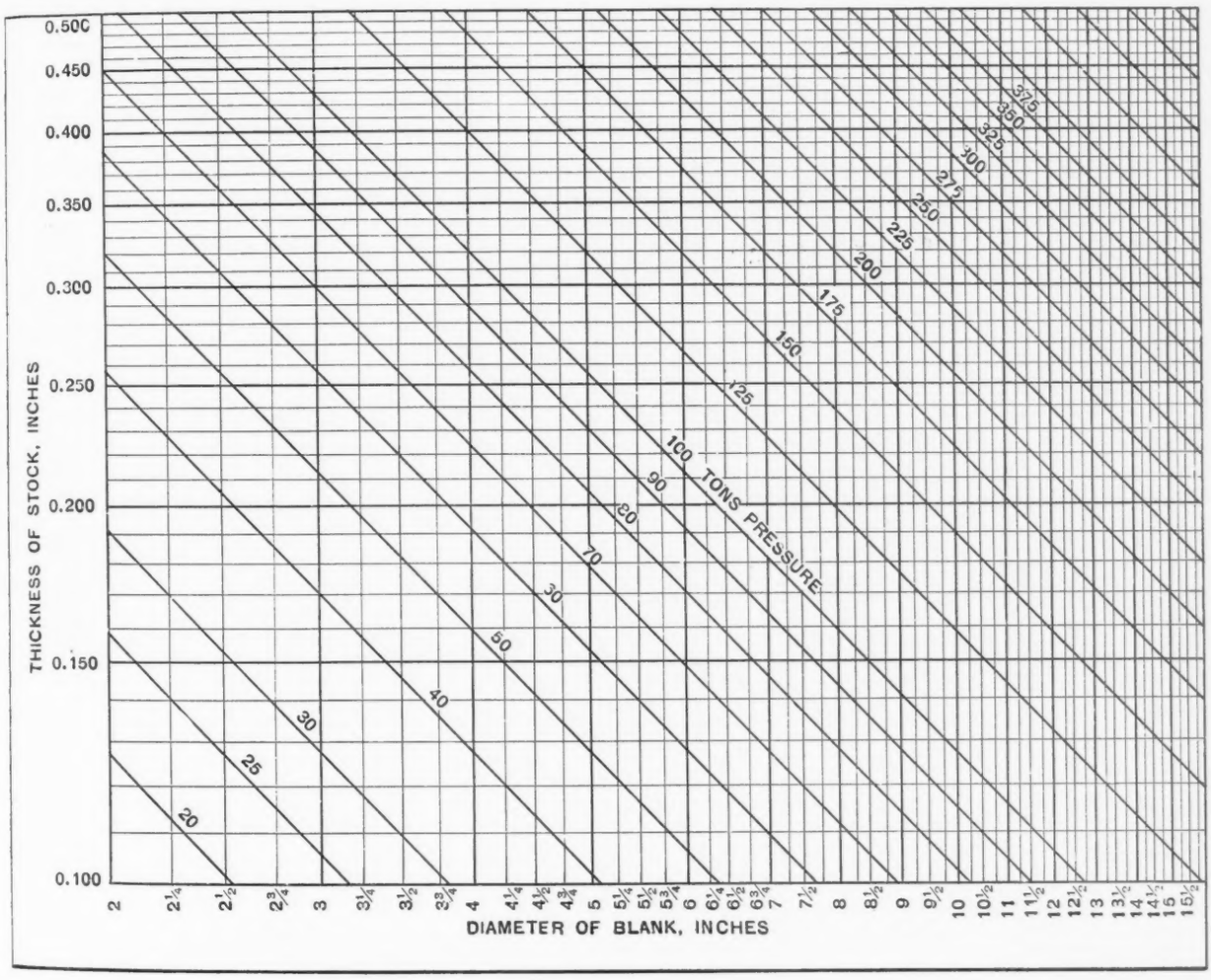


Chart for Determining Blanking Pressures for Mild Steel

New York City — B. J. STERN

CHECKING POSITIONS OF ANGULAR SURFACES AND HOLES

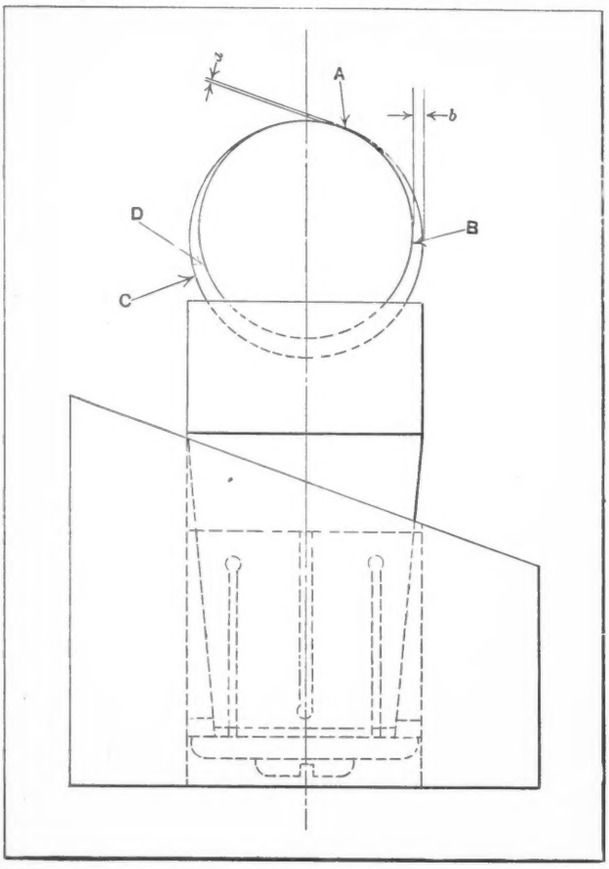
The method of checking the position of angular surfaces and holes described on page 924 of August MACHINERY should prove interesting and useful to many metal workers. Two items, however, are

open to criticism. As is well known, hardened steel changes its shape and size when annealed and, in addition, its surface is likely to be affected by the formation of scale. A 1 1/2-inch steel ball, annealed without scaling, shrank about 0.0033 inch and became out of round about 0.0003 inch when annealed.

Assuming that the 1-inch ball shown at *C* in the illustration, shrinks 0.002 inch in annealing, a negligible error *a* would exist at point *A*, while the error at *B* would be equivalent to one-half the total shrinkage of the ball, plus or minus any variation from sphericity at the gaging point. Hence, the error at *B* would probably be more than 0.001 inch.

Another and possibly more serious fault is the way in which the fit is obtained between the ball-holder and the bore. The provision for tightening the fit of the holder at one end only may result in the ball being thrust to one side or out of alignment with the axis of the hole. Obviously, some tightening arrangement that will maintain a close approach to concentricity and alignment should be used. A holder turned to a taper and fitted with an expanding shell, as indicated in the accompanying illustration, is suggested for this purpose. The end that holds the ball should be counterbored concentrically to receive the ball, which should be held firmly to its seat while being soft-soldered in place. Care should be taken to use a solder which melts at such a low temperature that there will be no danger of drawing the temper of the ball.

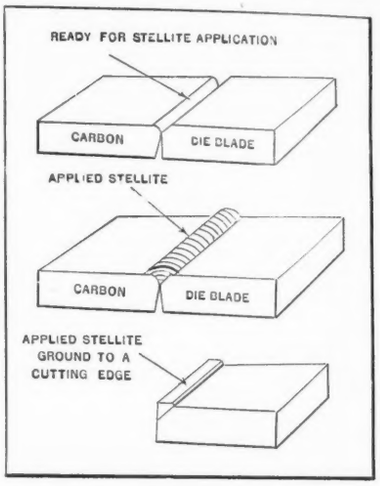
Wilkinsburg, Pa. WILLIAM S. ROWELL



Shrinkage of Ball C to Size D Shown Greatly Exaggerated to Illustrate Effect of Annealing

APPLYING STELLITE TO TRIMMING DIES

Some time ago the writer read an article in MACHINERY that described the use of stellite on the cutting edges of dies. This practice appeared to be applicable to the repair of hot-trimming dies, and it was decided to try it out in the plant of the Madesco Tackle Block Co., Easton, Pa. With the information available and the cooperation of the Stellite Co., remarkable results were obtained after a little experimentation.



Diagrams Illustrating Method of Applying Stellite to Cutting Edge of Die

The application of stellite to worn dies by the use of an oxy-acetylene torch proved so satisfactory that the process was applied to new dies. As a result, all the new dies are now made from mild steel at a great saving in cost. These soft steel dies with stellite cutting edges are much easier to make than carbon steel dies, and there is no loss in hardening and no warping to contend with. When an old carbon steel trimming die breaks, it can be satisfactorily repaired by using stellite to join the parts.

The accompanying diagrams illustrate the procedure followed in applying the stellite to a die. The old die is cut away at an angle of about 45 degrees to a depth of about 1/8 inch from the top surface. A piece of carbon cut to the same shape as the die is used, when possible, as a guide in welding on the stellite. The upper view in the illustration shows how the carbon and the die are arranged to give a smooth job and conserve the stellite. The carbon can be kept for future use or reshaped for the next job.

Before the stellite is applied, the die should be heated with a hot flame from the torch until it is sufficiently hot to fuse with the stellite. The air supply should then be cut down to give a "soft" flame. This causes the stellite to flow more evenly and prevents the formation of small holes. The stellite should be built up about 1/16 inch above the surface of the die. When the welding is completed, the work should be allowed to cool in the air.

In grinding the built-on stellite, just enough metal is removed to give a straight cutting edge. Generally the ground surface is about 1/32 inch high, as indicated in the lower view of the illustration. This raised surface allows for resharpening. Dies with cutting edges of stellite, built on and ground as described, have been found to last about ten times as long as any of the carbon steel dies previously used.

Easton, Pa. CHARLES E. HARRIMAN

Shop and Drafting-room Kinks

CLEANING RUBBER ERASERS

The use of an eraser for removing soft lead pencil lines on vellum drawing paper invariably results in smudging the drawing unless the graphite that accumulates on the eraser is removed at frequent intervals. Some draftsmen do this by simply cutting off the tip of the eraser, but this rapidly reduces its length. A better method is to rub the soiled eraser over a piece of emery cloth. The reverse side of the drawing, immediately under the lines erased, should, of course, also be cleaned.

Philadelphia, Pa. SAMUEL KAUFFMAN

LOCATING PARTS FOR SPOT-WELDING

A simple means for holding two stampings in correct relationship with each other while they are being spot-welded is shown in Fig. 2. The arms *B* in Fig. 1 are located on the ring *A* by the two dowel projections *D*, Fig. 2, which drop into the holes *C* in the ring.

Formerly a light fixture was employed for holding the arms in position for welding, but on account of the awkwardness of handling, this was discarded and replaced by the method just described. This entailed only the addition of the round punches in the blanking dies for forming the projections in the arms and for piercing the mating holes in the ring. W. P.

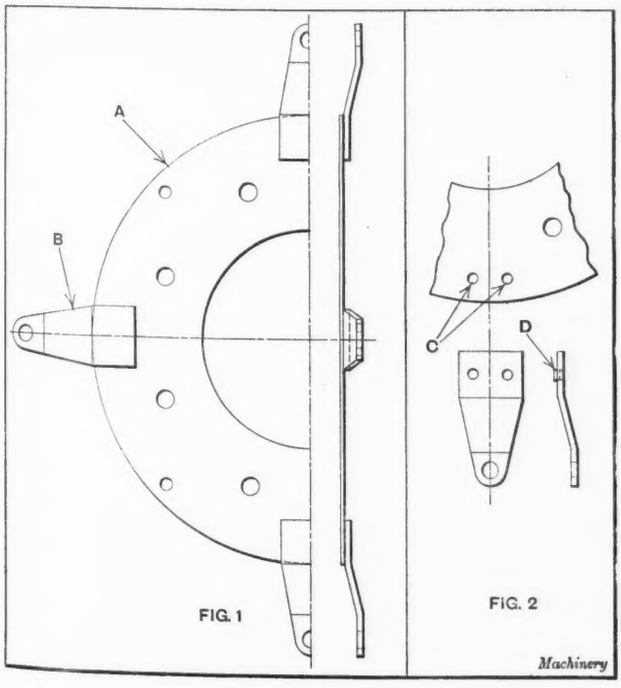
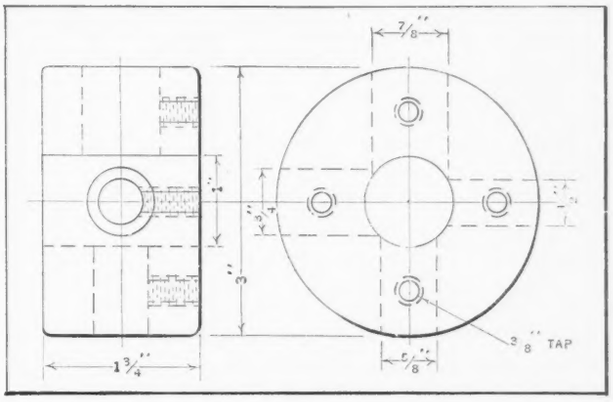


Fig. 1. Ring and Arms to be Assembled by Spot-welding
Fig. 2. Method of Locating the Arms for Welding



Fly-cutter Holder, of Economical Design, Used on Standard Milling Machine Arbor

A CONVENIENT FLY-CUTTER HOLDER

The cutter holder shown in the illustration, which is more flexible in some respects than the ordinary fly cutter, was designed by the writer. It is used on the regular cutter-arbor of a milling machine. The holder is of cold-rolled steel with a center hole of 1-inch diameter fitting a standard 1-inch milling machine arbor. Four holes are drilled and reamed in the holder as shown, ranging from 1/2 to 7/8 inch, in order to accommodate four different sized cutters. The cutters are made of drill rod of the most convenient size for the particular job in hand, and are held in place by set-screws.

The advantages of this type of holder are as follows: It is cheaper to make; it gives a choice in the size of steel from which to make the cutter; it is as flexible as a regular milling cutter, because it fits the same arbor; and the roughing of the job can be done with a regular cutter, after which the change to the form fly cutter can be made with less trouble than when a regular fly cutter is used.

Cleveland, Ohio C. H. HAYS

PREVENTING WHEEL-TRUING DIAMONDS FROM CRACKING

Trouble was experienced in a certain plant recently from cracking of the diamonds used in truing up grinding wheels. An investigation showed that the cracking was caused by the practice of beginning the truing operation with the work and wheel running dry, and turning on the cooling water after the diamond had become hot. At first only minute surface cracks were formed by the sudden cooling. These cracks, however, became larger and deeper as the diamond continued in use. To remedy this trouble, it was only necessary to keep the wheel and the truing diamond flooded with water during the entire truing operation.

Brighton, England W. E. WARNER

Questions and Answers

INCREASING THE SPEED OF A DRIVEN SHAFT

A. R. L.—In order to obtain the desired operating conditions in some types of machines, it is often necessary to increase the speed of a gear-driven shaft a certain per cent. This change in speed must be secured without changing the center distance between the driving and driven shafts and without any change in the speed of the driving shaft. To accomplish this, it is obvious that both the pinion on the driving shaft and the gear on the driven shaft must be changed. Will someone please give a simple formula or method for finding the number of teeth required in each of the new gears in order to obtain a certain per cent increase in the speed of the driven shaft?

Answered by P. R. Kemble, Blue Ash, Ohio

In preparing a formula for the solution of this problem, we will let:

t = number of teeth in present driving gear;
T = number of teeth in present driven gear;
C = center distance between gears;
P = diametral pitch of gears;
p = per cent increase in speed of driven shaft (revolutions per minute); and

$$R = \frac{T}{t + (t \times p)} = \text{new gear ratio.}$$

Having given the numerical values for the foregoing elements, find:

t_1 = number of teeth in new driving gear; and
T_1 = number of teeth in new driven gear.

For the gear on the driving shaft we have,

$$t_1 = \frac{2 \times C \times P}{R + 1}$$

For the gear on the driven shaft we have,

$$T_1 = (2 \times C \times P) - t_1$$

Example—The driving and driven gears of a machine have 20 and 76 teeth, respectively. The center distance between the two shafts is 6 inches, and the diametral pitch 8. Using the same center distance and gears of the same diametral pitch, how many teeth should there be in the driving and the driven gears in order to obtain an increase in the speed of the driven gear of 20 per cent? The speed of the driving gear is to remain the same. Substituting numerical values in the formula for the driving gear we have,

$$t_1 = \frac{2 \times 6 \times 8}{3.17 + 1} = 23 \text{ teeth}$$

In this case,

$$R = \frac{76}{20 + (20 \times 0.20)} = 3.17 \text{ approximately}$$

For the driven gear we have,

$$T_1 = (2 \times 6 \times 8) - 23 = 73 \text{ teeth}$$

In case it is desired to obtain a certain per cent decrease in the speed of the driven gear, it is only necessary to change the formula for the new gear ratio so that it reads:

$$R = \frac{T}{t - (t \times p)}$$

The gear ratio R is often of such a value that the new center distance for the driving and driven gears does not correspond exactly with the original center distance between the two shafts. This difference, however, can generally be compensated for either by enlarging the blanks to increase the new center distance or by reducing the size of the blanks to decrease it, assuming that the teeth are cut by a generating process. (See MACHINERY'S Data Sheets Nos. 79 and 80, April, 1926, "Modified Center Distances for Spur Gears.")

In some cases, it may be desirable or necessary to use gears of a larger or smaller diametral pitch than the original ones. For example, a pair of 8 diametral pitch gears having pitch diameters of 2 and 4 inches and a center distance of 3 inches is to be replaced by gears having pitch diameters of 2 1/3 and 3 2/3 inches. In this case, it is obvious that 8 diametral pitch gears could not be used, whereas 6 diametral pitch gears would be satisfactory.

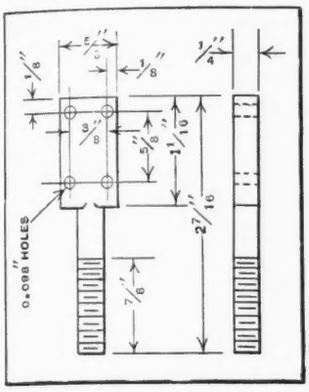
PRODUCING NARROW SOFT IRON STRIPS

S. S. I.—I would be glad to obtain some ideas in regard to a problem involving the production of narrow strips 1 inch wide and 36 or 38 inches long, made from soft iron either 0.009 or 0.015 inch thick and produced with a tongue shape on each end. The strips must be straight—not snaky—and the edges must not be concave or convex more than 0.003 inch over the entire length. In the past, these strips have been made by shearing them from sheets with a square shear, but the shearing action imparts a bow to the strip. Different methods of shearing have been tried, but a concave edge has always been the result. Also, the shearing is a rather slow operation.

A blanking die with a pressure pad to hold the blank under tension while blanking is now being considered. Would this method prevent the strip from having a snaky effect or can any better way of doing this job be suggested? Is it possible to obtain steel strips or coils from the mills in 1-inch widths, which, when cut off in 38-inch lengths, will lie flat, straight, and not show concave or convex edges over the entire 38-inch length? Any assistance that MACHINERY'S readers can furnish in the solution of this problem will be appreciated.

PIERCING HOLES IN BRASS PART

F. K. A.—We would like to know the best method of piercing or perforating the four 0.098-inch holes in the part shown in the accompanying illustration. The material to be used in making this part is half-hard brass strip stock. It is desirable to avoid, as far as possible, any appreciable bulging of the part at the sides near or adjacent to the holes. The pieces are to be made in large quantities. Can any of MACHINERY'S readers describe a satisfactory method of handling this job?



Brass Part with Four Pierced Holes

FINDING RADIUS OF SEGMENT OF CIRCLE

A. L. M.—In the accompanying illustrations, the segment S represents a portion of a cylinder, the radius CH of which is desired. Assuming that the segment S and square blocks T rest on an accurate surface plate, and that the measurement over the outer surfaces of the blocks is 16 inches, what would be the radius of the cylinder?

Answered by Stuart B. Reynolds, Brooklyn, N. Y.

It is assumed that the blocks have sharp edges and make perfect contact with the surface of the cylinder. The two different solutions to this problem given here do not involve the use of trigonometrical functions, as does the solution given in January MACHINERY, page 392. This problem affords a good illustration of how numerical work may be simplified, thereby reducing the chances of error, by carrying the mathematical processes through to their conclusion before substituting numerical values. For the first solution, reference is made to Fig. 1, in which C is the center of the circle representing the face of the cylinder.

In the right-angle triangle ABC,

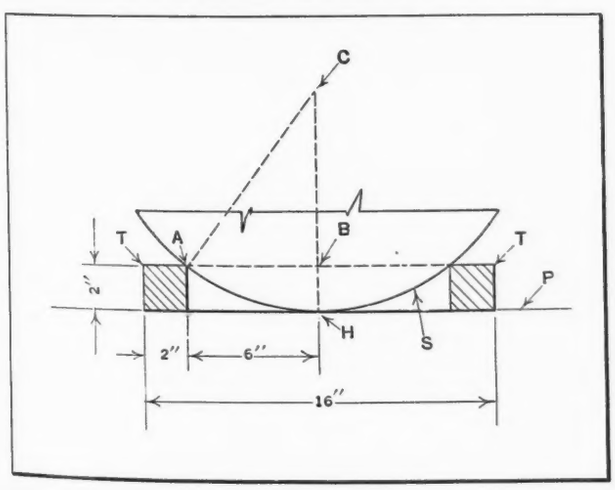


Fig. 1. Diagram Used in Finding Radius of Circle

$$(CA)^2 = (AB)^2 + (CH - BH)^2$$

Squaring the last term of this equation, we have

$$(CA)^2 = (AB)^2 + (CH)^2 - 2(BH \times CH) + (BH)^2$$

Now as $CA = CH$, we obtain by substituting the numerical values $AB = 6$ and $BH = 2$ in this equation

$$(CH)^2 = 6^2 + (CH)^2 - 4CH + 2^2$$

Transposing and uniting terms, we have

$$4CH = 40 \text{ and } CH = 10 \text{ inches}$$

Reference is now made to Fig. 2 for the second solution. First draw $AG = 4$ inches and complete the triangles ACH and AHG. As the angles E are equal, the triangles ACH and AHG are similar

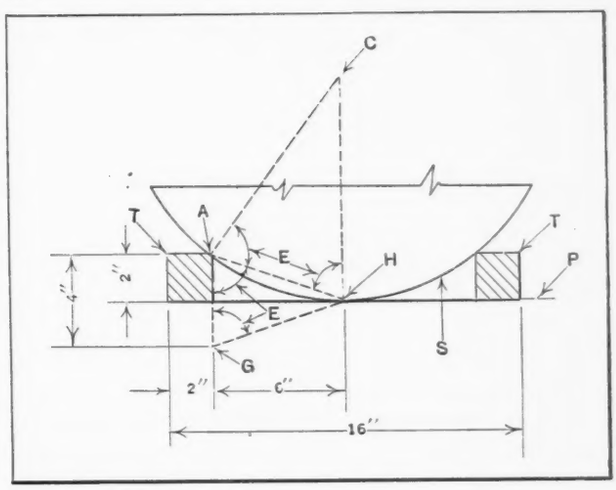


Fig. 2. Diagram for Second Solution of Radius Problem

isosceles triangles and their corresponding sides are proportional. Thus,

$$\frac{CA}{AH} = \frac{AH}{AG} \text{ and } CA = \frac{(AH)^2}{AG}$$

According to geometry,

$$(AH)^2 = 2^2 + 6^2 = 40$$

Now as $AG = 4$, we have

$$CA = \frac{40}{4} = 10$$

As $CA = CH$, we have

$$CH = 10 \text{ inches}$$

[Similar solutions have also been submitted by A. J. Pruszynski, Chicago, Ill., Erik Bonander, Calumet City, Ill., Frank Legrady, Cleveland, Ohio, S. Khatunzeff, Rochester, N. Y., Carl Huhndorff, Jr., Port Arthur, Tex., George X. Johnston, St. Clair, Mich., and M. G. Van Voorhis, Cleveland, Ohio.]

* * *

According to the *Bank for Russian Trade Review*, there are now more than 35,000 tractors in use in the Soviet Union. A factory having an output of about 3500 tractors per year is at present in operation at Stalingrad.

Cutting Steel with the Oxy-acetylene Torch*

Methods Used in Cutting Steel Shapes with the Gas Torch for the Fabrication of Machine Frames, Housings, and Other Machine Parts

By F. E. ROGERS, Applied Engineering Department, Air Reduction Sales Co.

DURING the last few years, the use of fabricated steel plates and structural shapes, assembled by welding, has greatly increased for such purposes as machine bases, frames, housings, uprights, rotors, and other machine parts. Oxygen cutting has proved a convenient and economical method of cutting steel plates to the shapes required for work of this kind.

The process of oxygen cutting of steel, wrought iron, and cast iron consists of burning the metal along a predetermined path with a jet of oxygen after the metal has been preheated at the starting point to a bright red heat. Only the red hot metal in the path of the oxygen jet burns, while the cooler metal adjacent is unburned and practically unaffected beyond a narrow zone, usually less than 1/16 inch on each side of the cut.

The heating, preparatory to cutting, is done by a small flame or flames close to the central orifice in the torch tip through which the oxygen cutting stream issues. The gas for the preheating flame that has given the most general satisfaction is acetylene. Hence, the process, when acetylene is used for preheating, is known as "oxy-acetylene cutting." The number of heating flames varies from one to six—seldom more. One flame is rarely or never used, but it is seldom that more than four or five are required, except when cutting cast iron. The use of four or five preheating flames insures that one or two flames will always be ahead of the oxygen jet when cutting in any direction in a plane parallel to the surface of the piece cut.

Hand Torches for Oxy-acetylene Cutting

Oxy-acetylene cutting was practiced at first with hand torches exclusively, and the hand torch is still the principal gas cutting tool. The operator holds the torch at the required height from the work and follows the line of the cut. He must move the torch steadily to keep in step with the cutting action. If the torch is moved along the cut much faster or slower than the cutting action, the cut is "lost," and a new start must be made.

As with other hand operations, the accuracy, smoothness, and efficiency of the cutting depends upon the skill and care of the operator. The thicker the metal, the more difficult hand-cutting becomes, owing to the slow rate of progress required, compared to most hand movements, and the necessity of holding the torch so that the cutting edge will

Fig. 1. Cutting Hand-hole Covers to Shape with a Camograph; Cutting Speed, 12 Inches Per Minute

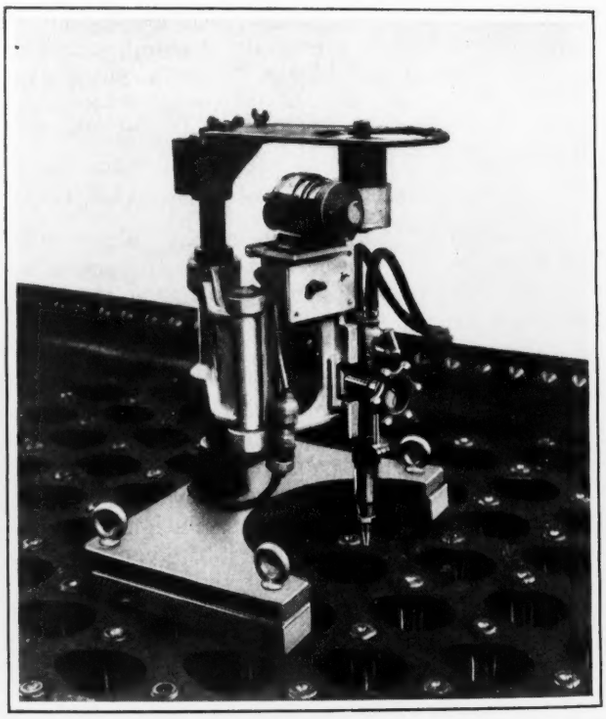


Fig. 2. Cutting Hand-holes in a Water-tube Boiler Header, Shifting by Hand from One Hole to the Next

*Abstract of a paper presented at a joint meeting of the American Welding Society and the American Society of Mechanical Engineers, New York, January 7.

be projected squarely through the piece. Slight variations in the side angle at which the torch is held, and variations in speed that might have little noticeable effect on thin plates, are likely to produce shape defects when thick plates, slabs, and forgings are being cut. The shape of the cut is likely to have one form at the top surface and another at the bottom.

Efficiency in cutting refers to consumption of oxygen and acetylene, as well as to the cutting time. The volume of oxygen used is almost directly proportional to the volume of steel oxidized and displaced in the cut. The wider the kerf, the greater the weight of steel burned away and the larger the volume of oxygen used. The hand torch operator cuts a wider kerf than a machine torch, because the torch in his hands wavers slightly from side to side and the cutting jet covers a wider area.

These limitations of hand-cutting were recognized years ago, and one of the first efforts to improve the characteristics of the cutting torch was the application of two small wheels on an axle to support the torch at the proper height and angle. The axle is provided with means for clamping the cutting tip to the axle at the height required for cutting. Thus equipped, the torch can be pushed or pulled along with the assurance that the tip will be held constantly at the correct side angle and height from the surface. This device, never very popular in this country, is used abroad, especially in shipyards, to make cuts in large plates.

Development of Cutting Machines

A straight-line cutting machine was developed shortly after the invention of the oxy-acetylene welding torch. Such a machine is operated by hand-wheels or cranks, but the hand-driven cutting machine requires the constant attention of the operator, and under some conditions of operation, it is difficult to turn the crank at a constant speed and give the necessary attention to the torch, especially as the cutting speed may vary from, say, 3 inches per minute on heavy work to 25 inches or more per minute on thin plates.

The next step in the application of the gas-cutting method was the development of a self-propelled cutting machine employing motor drive. Such cutting machines are made in three general classes—portable, semi-portable, and stationary. In shipyards, bridge works, and industrial plants where a large tonnage of steel plates is handled daily, requiring trimming, splitting, beveling, and cutting to length, portability is important.

One type of portable machine is known as the "Radiagraph." This machine, weighing about 120 pounds, carries a straight-head machine-torch with means of setting the torch at any angle required for beveling or cutting a calking edge. A compound slide rest provides for vertical and horizontal adjustments. The carriage of this machine has three small wheels, two being tractors and the third a free wheel. When straight lines are being cut, the wheels run on a grooved track and when circular arcs or circles are being cut, the machine revolves around a pivot point fixed to a radius rod. In the latter case, only one of the tractor wheels is used for a drive, and the free wheel, which is mounted like a caster, follows the path set by the radius bar. This machine is used largely for fabricating shapes from steel plates or slabs.

The Camograph—a Semi-portable Cutting Machine

Another machine, in the semi-portable class, weighing about 150 pounds, is known as the "Camograph." (See Figs. 1 and 2.) This machine can be taken to the job or, when the parts are easily handled, used in a stationary position.

Unusual and interesting means are employed for guiding the cutting torch. The torch is mounted on a vertical slide at the outer end of a double hinged arm. The hinged arm is supported by a vertical post fixed in a U-shaped base. At the top of the post is a cam-holder designed to hold, in a horizontal position, an internal cam, that is, a plate having an opening, the shape of which is approximately the shape to be cut. In contacting with this inner surface is a magnetic roller driven by a variable-speed motor. As the magnetic roller turns on its axis it follows the cam shape and carries the straight-head torch with it, cutting the shape below. Only one shape can be cut with a cam. Hence, this is a repetitive production cutting machine. Boiler hand-holes, hand-hole covers, rubber heel dies, and tube supports in water-tube boilers are a few of the shapes cut with this machine.

Multiple Oxy-acetylene Cutting

Machines have also been designed for multiple cutting of shapes, using two or more torches on one thickness of steel plate; for cutting in multiple from a stack of two or more plates with one torch; or for cutting shapes from a stack of two or more plates with two or more torches. Multiple cutting of plates in stacks is being practiced to advantage in airplane plants for cutting small shapes from thin steel plates, twelve or more shapes being cut at once with one torch. The conditions that must be met in multiple cutting are more exacting than with single piece cutting of a thickness equal to the height of the stack. A machine, flexible in operation and not rigidly held to starting at a particular spot, is necessary for the best results.

Cost of Oxy-acetylene Cutting

As an example of the cost of oxy-acetylene cutting, the following figures are given. A 10-inch circle is cut smoothly from 3/4-inch low-carbon steel in two or three minutes at a cost of about 20 cents, computing oxygen at $1.25 per 100 cubic feet, acetylene at $2.50 per 100 cubic feet, and the operator's wages at 80 cents per hour. A 10-inch circle in 2-inch steel costs more, of course, because the cutting is slower and more gases are used.

Many examples could be cited that would show gas cutting costs to be extremely low, compared to the costs of producing the same shapes by other methods. Costs of cutting the same shape vary, depending on the thickness and quality of cut re-

quired. A slower cutting speed must be used on heavy sections, especially if a smooth surface with minimum drag is required. Hence, a direct statement of cutting costs cannot be made without knowing the quality of steel, thickness, permissible drag, and smoothness of cut desired.

If the most economical cuts are wanted, the speed is set at the highest rate that can be maintained without interruption. The drag may then result in some deformation of the lower side shape, compared with the top shape. This will be especially noticeable on shapes in which the direction of cut changes suddenly. If the cut shapes are to be used without subsequent finishing, then the cutting speed should be reduced so that the drag is not more than, say, from 1/10 inch on a 1/2-inch thickness to 1/4 inch on a 2-inch thickness. This means that the curved line representing the cut should not fall behind the vertical at the top more than the amount stated when a smooth finish is wanted.

A common empirical rule for measuring the efficiency of oxygen consumed is to compare the number of cubic feet used with the area of the cut surface, measured on one side of the kerf only. Economical machine cutting of 1/2-inch plate is realized when 8 square inches of cut surface are produced by one cubic foot of oxygen. This means that 16 inches of 1/2-inch plate are cut.

Effect of Cutting on Steel

What effect has this burning process on the steel next to the cut? Low-carbon steel used for ship plates, machine bases, structural shapes, and the great mass of steel applications may be cut with no fear of detrimental effects. Steel containing much more than 0.30 per cent carbon, as a rule, should be warm when cut, and annealed after cutting, when employed for machinery parts, or a liberal machining allowance should be made to insure that the steel affected by the local heat will be removed. Contrary to general impression, this heat effect is chiefly mechanical. The grain structure is practically unchanged beyond a narrow zone, usually less than 1/16 inch thick, unless it be in a very thick section. The mechanical effect is a state of tension in the surface layers of the cut surfaces, due to local heating and upsetting of the metal as the cut is being made. Annealing relieves the tension and machining removes the metal affected.

Fabrication of shapes from rolled steel has great possibilities and economic advantages. Two concerns building mine locomotives have cut their side frames from rolled slabs for several years. Cutting is done so smoothly and accurately that no machine finish is necessary on the jaws embracing the driving boxes.

The mechanically operated torch makes possible the conversion of rolled steel sheets, plates, and slabs to shapes suitable for welding into assemblies, or to take the place of forgings. When used in conjunction with the forge shop, the production of large multiple-throw crankshafts is simplified and the cost reduced. These applications selected at random by no means give a complete picture, but may serve to suggest the wide field of oxy-acetylene machine cutting.

American Society for Steel Treating Meets in New York

The American Society for Steel Treating held its semi-annual meeting at the Hotel Pennsylvania, New York, February 7 and 8. Among the papers presented was one on new developments in treating nitrided steels so as to make them soft enough to machine. This method was described by W. J. Merten, metallurgist of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

One of the most frequent objections to the use of nitrided steels in die molds or other tools that sometimes have to be changed has been that nitrided steel cannot be annealed successfully by ordinary methods. Heating the steel to temperatures up to 2000 degrees F. does not render the nitrified case machineable by ordinary cutting tools. Even uniform grinding has proved difficult. Furthermore, these high annealing temperatures cause excessive distortion.

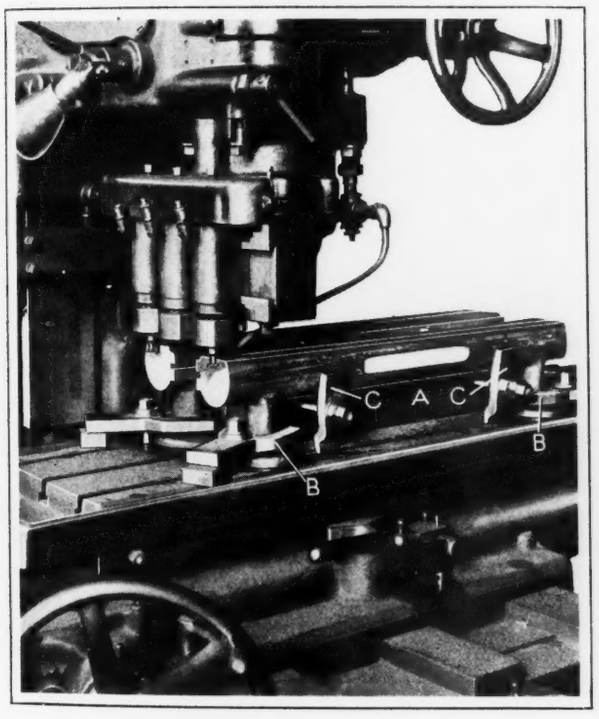
A process has been developed, however, by which nitrided steel can be softened; briefly, the procedure is as follows: Immerse the work in fused salt, of large enough volume, at a temperature sufficiently high to keep liquid when the piece is immersed. Heat the steel to from 1450 to 1500 degrees F., and hold the heat for a sufficient length of time to give uniform penetration. Cool slowly to slightly above the freezing point of the salt, and hold the temperature there to equalize it throughout the piece. Withdraw the piece, shake off the adhering salt film, and cool it in lime. For a deep case, hold at a high heat from two to three hours. Molybdenum steels with over 0.5 per cent molybdenum have air hardening characteristics; therefore it is essential that the steel be cooled slowly in the bath. Distortion also is kept to a minimum. A Brinell hardness of 250 usually is obtained on denitrided parts, permitting machining. Any adhering salt film must be removed by washing in boiling water before the soft parts reach a temperature below 200 degrees F.

Another paper read at the meeting covered "Recent Developments in Normalizing Sheet Steel," by Edward S. Lawrence, Duraloy Co., Pittsburgh, Pa. Joseph Winlock, and George L. Kelley, of the Edward G. Budd Mfg. Co., Philadelphia, Pa., read a paper on sheet and strip steel for automobile bodies. Charles McKnight, International Nickel Co., Inc., New York, read a paper on nickel alloy steel forgings. The effect of the addition of chromium to manganese chromium steels was dealt with in a paper by A. B. Kinzel and W. B. Miller of the Union Carbide & Carbon Research Laboratories, Inc., Long Island City, N. Y.

MAKING PRODUCTION EQUIPMENT MORE EFFICIENT

By ARTHUR ALDRICH

New ways and means of doing a job in less time is the thought uppermost in the minds of production engineers and mechanics who are keenly interested in their work. In many cases, an appreciable saving in time can be effected at little expense by devising new set-ups or simple fixtures for the present shop equipment. The accompanying illustrations show how a saving in production time of approximately 30 to 40 per cent was accomplished in this way. A vertical milling machine which had long since completed its "apprenticeship" is shown equipped with a special three-spindle head for milling the T-slots in two bench lathe beds. With the previous method, only one bed was milled at a time.



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An accurately machined fixture *A*, Fig. 1, is mounted on the milling machine table. As the fixture block is held in the T-slots of the machine table, it is an easy matter to line up the lathe beds preparatory to milling. Each bed is securely held by two arms *B* bolted to the table. Straps *C* are placed against the bed and held in place by bolts which pass through the fixture and hold both beds in place. Compressed air is piped to the cutters in order to keep the slots free from chips.

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The same bolts that pass through the fixture blocks shown in Fig. 1 are used for holding the lathe beds in the second machining position. Accurate alignment and uniformity of the T-slots is assured by this method of locating and holding the work in place.

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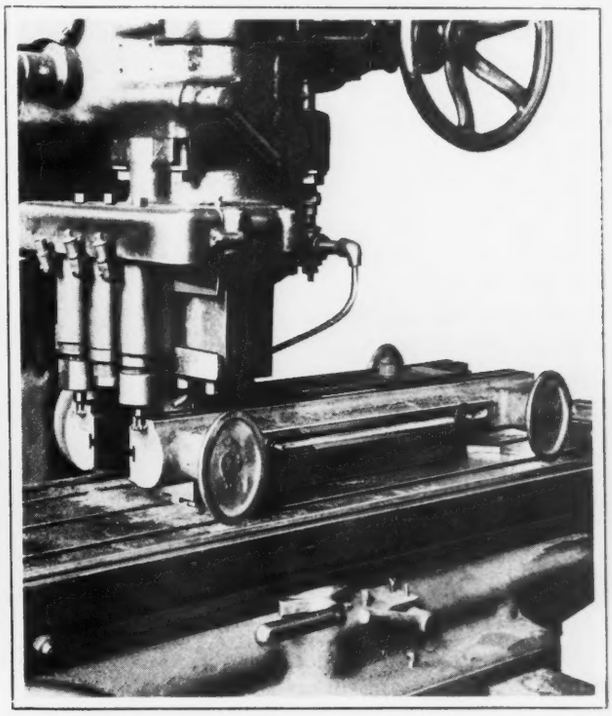
In connection with the thirty-fourth annual convention of the American Foundrymen's Associa-



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An added feature of the exhibition this year will be an educational and technical display prepared by various committees of the American Foundrymen's Association, including testing apparatus, apprentice material, and exhibits of engineering schools and of a metallurgical and physical testing laboratory. Further information may be obtained from the Executive Secretary, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

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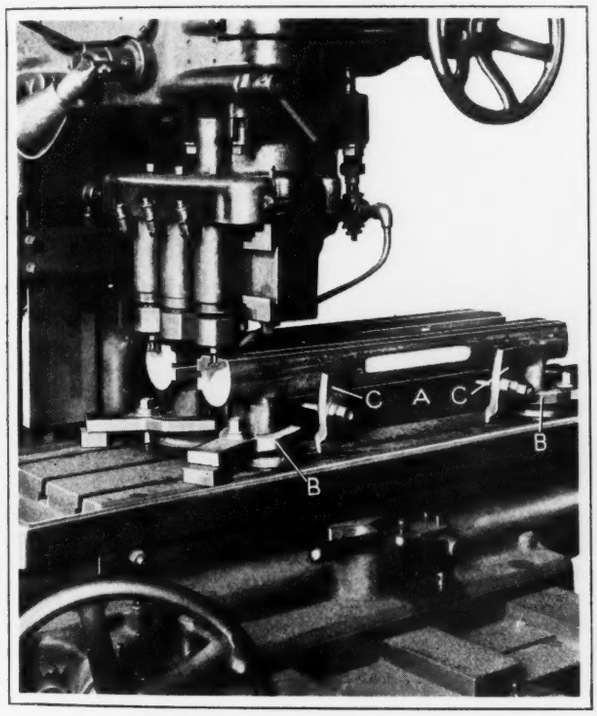

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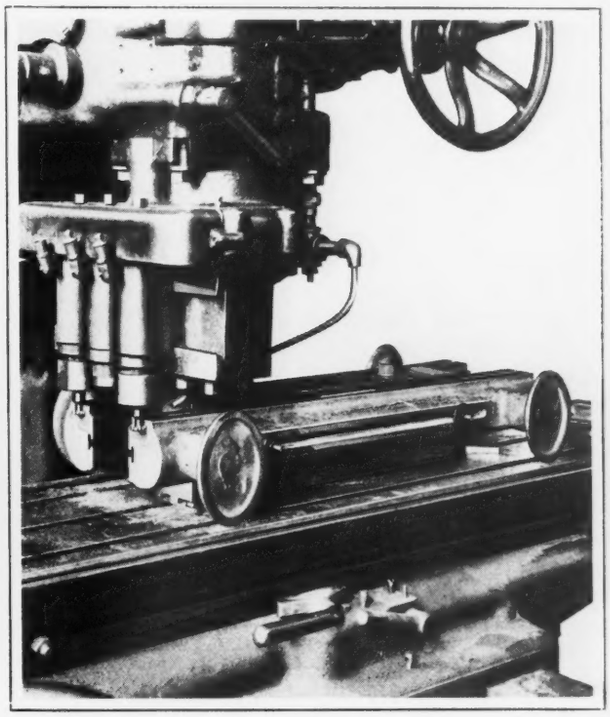

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The British Metal-working Industries

General Conditions are Satisfactory, the Greatest Activity Being Evidenced in the Electrical and Airplane Industries

From MACHINERY's Special Correspondent

London, February 20, 1930

ALTHOUGH a quiet tone is noticeable in some branches of the metal-working industries, this is considered to be seasonal. Productive industry is busy, and the brightest conditions obtain where the product is either of a special nature or has a wide field of application.

Electrical engineering is perhaps the most active field, a steady volume of business developing, particularly in connection with electric projects. The Central Electricity Board, which has been given unfettered powers with regard to the control, generation, and distribution of electricity in this country, has already placed orders with British firms to the value of £10,600,000, and additional orders are about to be placed.

Textile machinery builders are still waiting for the recovery of the home cotton industry, which is much in need of new machinery, but a brighter future is anticipated as a result of the reorganization now going on, especially in spinning mills. The shipbuilding industry is receiving a fillip, and overdue railway development schemes and improvements are promised.

Activity Prevails in the Airplane Industry

Considerable activity prevails in the airplane and air-engine field. The plant of the Bristol Aeroplane Co., Ltd., has recently been subject to important extensions, so insistent is the demand for the Bristol "Jupiter" air-cooled engines. In spite of the fact that work is proceeding both day and night, it has been found necessary to make arrangements for the manufacture of the "Jupiter" in fourteen other countries under Bristol license.

In the automobile industry, and among the trades dependent upon it, there is no real evidence of restraint on production.

Although the production of sound film machinery is well advanced in America, the possibilities do not appear to have been fully exploited in this country. There is a feeling of confidence, however, among firms engaged on work of this nature, and steady progress is being made such as is likely to offer new scope to makers of precision machines.

Conditions in the Machine Tool Industry are Encouraging

Conditions in the machine tool industry vary according to district, but generally may be regarded as encouraging. The December returns indicate that the exports and imports of machine tools were much the same as the average of the previous eleven months. The exports amounted to 1176 tons, as compared with 1410 tons in October and 1480 tons in November, the corresponding values for the three months in the order given being £160,919, £175,248, £187,491.

The tonnage of imports was higher than in November but lower than in October, the figures being, October 1241 tons, November 969 tons, December 1008 tons, the values being, respectively, £205,326, £165,624, £164,963.

In comparison with the total overseas trade during the last three years, the exports of machine tools are increasing more rapidly than the total exports, while the imports of machine tools have more than doubled, although the total imports are practically stationary. The machine tool industry is on the rising slope. It is showing a gradual expansion, and not a boom.

Shipbuilding Industry Reports the Construction of an Increasing Number of Motorships

There is a mixture of optimism and pessimism in the shipbuilding industry. The year 1929 was one of the best since the post war depression from the point of view of tonnage begun or launched and tonnage under construction. The total tonnage under construction for foreign countries during 1929 is likely to exceed pre-war figures for the first time since the depression.

The year has opened with a record number of orders for motorships. There are 350 vessels building, all above 1000 tons gross, with a total tonnage of 2,300,000. Of these 110, of 750,000 tons gross, are being built in British yards, and a large proportion of these are for foreign owners. The tonnage of motorships now under construction in Great Britain and Ireland is over 49 per cent of the total tonnage under construction.

New "Flying Car" May Make 200 Miles an Hour

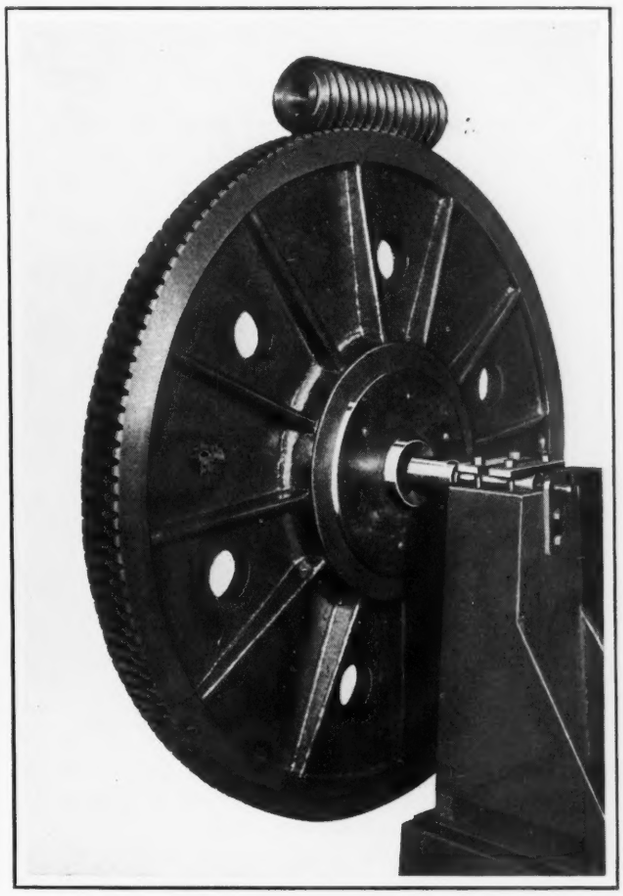
Will Scotland be the pioneer for high-speed public travel? It certainly will be, if the promoters of the experimental line now being erected near Milngavie realize their ambitious attempt. All the various parts of the scheme are well in hand, and not the least interesting is the experimental car now nearing completion in one of the prominent aviation establishments just outside Glasgow. Two hundred miles an hour is being freely talked about, and should the experiment meet with success, a line linking Glasgow and Edinburgh will probably be the first venture, and the journey between the cities, it is expected, will occupy 20 minutes. The motive power of the traveling or, rather, captive flying car will be air propellers driven by 450-horsepower gas engine placed both fore and aft in the self-contained vehicle.

Making Precision Worm-wheels of Large Size

Description of a Worm and Worm-wheel of Extreme Accuracy Used for Precision Indexing in the Manufacture of Automobile Gears

By O. G. SIMMONS, President and General Manager, The National Tool Co.

FOR the last five years the National Tool Co., of Cleveland, Ohio, has specialized in the manufacture of precision worms and worm-wheels for use in gear-cutting machines and other equipment requiring indexing devices of extreme accuracy. An example of the type of worm and worm-wheel made for this class of work is shown in the accompanying illustration. This particular worm and worm-wheel were made for the Citroen Gear Works of Paris, France.



Worm and Worm-wheel Used for Precision Indexing in the Manufacture of Automobile Transmission Gears

The outside diameter of the worm is 6.6242 inches, and its length, 17.7168 inches. It has a right-hand double thread, and the hole for the shaft is 3.189 inches in diameter. The diametral pitch is 2.540 inches, and the pressure angle, 20 degrees. The addendum is 0.3937 inch; the dedendum, 0.4528 inch; and the depth of the tooth, 0.8465 inch.

The worm has a scleroscope hardness of 90 to 95 and the pitch or interspacing of the ground thread is held within limits of plus or minus 0.0002 inch. The pitch diameter of the worm-wheel is 59.0562 inches. There are 150 teeth in this worm-wheel, and the customer's specification for the interspacing of the teeth was plus or minus 0.0003 inch from the theoretically correct position, for each tooth. On completing the worm-wheel, tests showed that the accuracy of the interspacing of the teeth was actually held within limits of plus or minus 0.0002 inch. Measuring this accuracy in angular movement, the maximum error in the tooth interspacing is practically 2.8 seconds.

A worm and worm-wheel of this kind, used for astronomical work, is usually considered excellent if the interspacing of the teeth is held within limits of 3 seconds. In thus expressing the accuracy in angular measurement, the diameter of the wheel is not taken into consideration. This comparison indicates the high degree of perfection now being demanded for gears used in automobile transmissions. In order to run quietly, the teeth of all the meshing gears must be accurately formed and spaced. The worm and worm-wheel illustrated were produced, not for the purpose of cutting one set of precision gears, but to permit precision gears of a high degree of accuracy to be produced on a quantity basis.

* * *

ARC WELDING IN SHIP CONSTRUCTION

According to a report on welding developments in 1929 by a committee of the American Welding Society, 33 W. 39th St., New York City, metal arc welding has been used extensively during the past year in the construction of merchant and naval ships. The policy pursued is to introduce the process gradually rather than to attempt to weld a complete ship. In merchant ship construction, the object is primarily to reduce costs, while in naval work, the object is to save weight. For example, sufficient weight was saved by using arc welding in constructing the new German 9000-ton cruisers to permit heavier guns to be mounted.

In the new 613-foot steamship *Pennsylvania*, built by the Newport News Shipbuilding and Dry Dock Co., 45,000 pounds of electrodes were used in the construction work. In a 272-foot yacht built by the same company, it is said that the utilization of welding methods assisted the architects in obtaining graceful lines.

At the present time the Charleston Dry Dock & Machine Co. has under construction a completely welded 120-foot oil tanker, and the Standard Steel Shipbuilding Corporation, a completely welded 65-foot yacht.

$400 in Prizes for Articles on Tools and Fixtures

MACHINERY offers fifteen prizes for the fifteen best articles describing unusual tools, jigs, fixtures, dies, gages, or measuring instruments employed in machine shop work to insure accuracy and increase production. The prizes are as follows:

Two prizes.....	each $50	in addition
Four prizes.....	each 30	to regular
Nine prizes.....	each 20	space rates

MACHINERY'S regular space rates will be paid not only for the prize-winning articles, but also for any articles accepted for publication that may not receive a prize.

Each contestant may submit as many articles describing different tools or devices as he wishes. All articles submitted will be entered in the competition, and all may be accepted for publication, but no contestant will be awarded more than one prize.

Articles entered in this competition should be addressed to the Editor of MACHINERY, 148 Lafayette St., New York City. They must be mailed on or before May 1.

Preparing Articles for the Competition

This competition applies to any special tools, jigs, fixtures, dies, gages, or measuring instruments that have been designed for a specific purpose to facilitate the work in a machine shop. Standard tools and devices regularly made for the market are not eligible, nor can a description of a device be accepted for the competition if the design has been described previously in any publication or text-book.

The competition is open to all, whether subscribers to MACHINERY or not. The general procedure in preparing an article for the competition is very simple:

1. Send a drawing or blueprint of the tool (or photograph if preferred—or both) that clearly shows all important parts of the device.

2. Describe as clearly as possible the purpose for which the device is designed and its action, or how it is used; state also, as far as possible, the advantages gained by the use of the tool, giving production figures, when available.

3. Mark the important parts of the drawing, such as clamps, levers, etc., with letters *A*, *B*, etc., and use corresponding letters to identify these parts in the description; thus: "Clamp *A* is held down by lever *B*, the end of which is cam-shaped." This will help to make the description readily understood.

4. Confine each article to one separate device.

Helpful Suggestions

Describe as clearly as possible both the purpose of the tool, jig, fixture, die, gage, or measuring instrument and its use. Describe the purpose first, mentioning the work or operation for which the tool is intended, and then describe the device itself and how it is used.

Confine each article to the description of a single tool or fixture. Do not attempt to describe all the operations on the part for which the tool is employed; describe simply the device and its operation, and mention, as far as possible, the advantages gained by its use, giving production figures when available.

Do not send descriptions of standard tools or devices available on the market, nor of devices that have previously been described in any publication. Articles must be in the mails on or before May 1.

Suggestions about Illustrations and Manuscripts

Clear blueprints or pencil drawings with distinct lines are satisfactory. They should be made on sheets of paper separate from the description. Send only drawings that are made to scale, with the various parts shown in correct relationship and proportion. Rough, free-hand sketches cannot be used. The drawing must show the assembled tool, fixture, die, or gage, although a diagrammatic drawing may often be substituted to advantage, especially if it illustrates more clearly the arrangement of the important parts of a complicated tool.

* * *

ORVILLE WRIGHT AWARDED MEDAL FOR AERONAUTICS

The Daniel Guggenheim Fund for Promotion of Aeronautics in 1927 established a medal to be awarded for notable achievements in the advancement of aeronautics. The Board of Award has thirteen members; four chosen by the American Society of Mechanical Engineers; four, by the Society of Automotive Engineers; and one each from England, France, Germany, Italy, and Japan, representing the foremost aeronautical society of each country. The Board has just announced its first award of this medal, which will be given to Orville Wright for "design and construction, with his brother, now deceased, of the first successful engine-propelled airplane." The presentation of the medal will be made in Washington on April 8 in connection with the celebration of the fiftieth anniversary of the American Society of Mechanical Engineers.

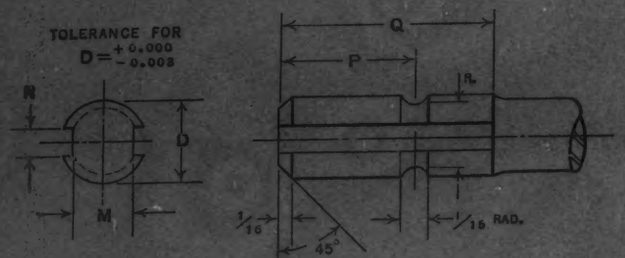
* * *

LARGEST MACHINERY EXPORTS ON RECORD

The exports of machinery of all kinds from the United States in 1929 amounted to a total value of over $612,000,000, an increase of $116,500,000, or 24 per cent, over the exports in 1928. Last year's exports were the highest ever recorded. Of these $278,000,000 represented industrial machinery, as compared with $225,000,000 the previous year. Power-driven metal-working machinery was exported to a value of $33,440,000 in 1929, compared with $27,421,000 in 1928. In December, the last month for which complete statistics are available, engine lathes were exported to a value of $113,000; turret lathes, $114,000; thread-cutting and automatic screw machines, $197,000; milling machines, $266,000; and grinding machines, $191,000.

DIMENSIONS OF BEAMAN & SMITH TAP SHANKS

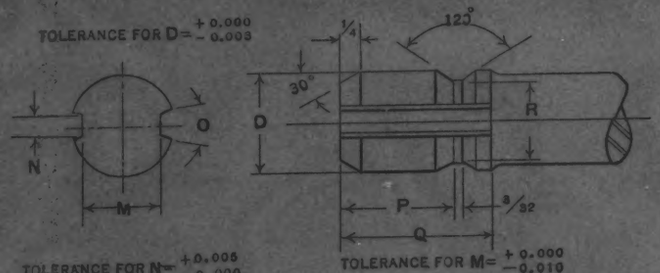
Adopted by Tap and Die Manufacturers



STYLE 1

Style 1 for Nos. 1 and 2 Beaman & Smith Holders

D	M		N		P	Q	R
	Min.	Max.	Min.	Max.			
3/8	0.220	0.240	0.110	0.120	5/8	1 1/16	9/32
1/2	0.340	0.360	0.120	0.130	13/16	1 5/16	13/32
3/4	0.520	0.540	0.200	0.210	13/16	1 3/4	21/32



STYLE 2

Style 2 for Nos. 2 1/2 and 3 Beaman & Smith Holders

D	M	N	O	P	Q	R
1 1/2	1 1/8	1/4	20 Deg.	1 3/4	2 1/4	1 1/4
1 5/8	1.180	5/16	16 Deg.	1 3/4	2 1/2	1 3/8
2	1.560	5/16	16 Deg.	1 3/4	3	1 3/4

DIAMETERS AND TOLERANCES FOR HAND TAPS

Adopted by Tap and Die Manufacturers

S. A. E. Standard—Cut (Unground) Threads
Commercial Tolerances for Hand Taps and Taps for Beaman & Smith Holders

S. A. E. Standard Screw Threads			Tap Measurements—Cut (Unground) Threads					
Size and Number of Threads	Basic Screw Thread Diameters		Major (Outside) Diameter			Pitch Diameter		
	Major (Outside) Diam.	Pitch Diam.	Minimum	Maximum	Tolerance	Minimum	Maximum	Tolerance
1/4–28	0.2500	0.2268	0.2525	0.2550	0.0025	0.2273	0.2288	0.0015
5/16–24	0.3125	0.2854	0.3155	0.3180	0.0025	0.2859	0.2874	0.0015
3/8–24	0.3750	0.3479	0.3785	0.3810	0.0025	0.3484	0.3499	0.0015
7/16–20	0.4375	0.4050	0.4410	0.4440	0.0030	0.4055	0.4075	0.0020
1/2–20	0.5000	0.4675	0.5040	0.5070	0.0030	0.4680	0.4700	0.0020
9/16–18	0.5625	0.5264	0.5670	0.5700	0.0030	0.5269	0.5289	0.0020
5/8–18	0.6250	0.5889	0.6300	0.6330	0.0030	0.5894	0.5914	0.0020
11/16–16	0.6875	0.6469	0.6925	0.6965	0.0040	0.6474	0.6499	0.0025
3/4–16	0.7500	0.7094	0.7550	0.7590	0.0040	0.7099	0.7124	0.0025
7/8–14	0.8750	0.8286	0.8805	0.8845	0.0040	0.8296	0.8321	0.0025
7/8–18	0.8750	0.8389	0.8765	0.8805	0.0040	0.8399	0.8424	0.0025
1–14	1.0000	0.9536	1.0060	1.0100	0.0040	0.9546	0.9571	0.0025
1 1/8–12	1.1250	1.0709	1.1310	1.1355	0.0045	1.0719	1.0749	0.0030
1 1/4–12	1.2500	1.1959	1.2565	1.2610	0.0045	1.1969	1.1999	0.0030
1 3/8–12	1.3750	1.3209	1.3820	1.3865	0.0045	1.3219	1.3249	0.0030
1 1/2–12	1.5000	1.4459	1.5075	1.5120	0.0045	1.4469	1.4499	0.0030

Lead Tolerance

A maximum lead error of plus or minus 0.003 inch in one inch of thread is permitted.

Thread Angle Tolerances

Threads per Inch	Permissible Error in One Half Angle	Permissible Error in Full Angle
10 to 28	Plus or Minus 45 Min.	68 Min.
30 or more	Plus or Minus 60 Min.	90 Min.

Taps with pitch coarser than S. A. E. standard will take U. S. standard tolerances.
The dimensions in this table apply to taps and not to tapped holes.

PROMPT REPLIES TO THE CENSUS BUREAU

In order to make the census figures on manufactures of the greatest practical value, the reports issued by the Bureau of the Census must be published early. In the past, these census reports have been late because of the failure of some manufacturers to make their returns promptly. It takes the Census Bureau only three weeks to publish the preliminary report for any industry after all the manufacturers in that industry have filed acceptable reports. Practically the entire delay in getting out census reports is due to negligence on the part of a few manufacturers.

In this connection, it is to the point to quote the following two telegrams. A manufacturer not long ago wired the Census Bureau as follows: "When will figures on our industry be available stop we have been waiting months for them stop such delay is inexcusable." To this the Census Bureau wired in reply: "All manufacturers in your industry except you filed their reports months ago stop you have ignored ten letters and two telegrams stop report on your industry ready months ago except for your figures."

* * *

DIAMOND-BORING AUTOMOBILE PISTONS

The equipment employed in diamond-boring the piston-pin holes of two aluminum-alloy automobile pistons simultaneously is illustrated in Figs. 1 and 2. This operation is performed on a Coulter diamond tool boring machine built by the Automatic Machine Co., Bridgeport, Conn. The pistons are ground cylindrically on a centerless grinding machine before they reach this boring operation, and can therefore be held accurately in the work fixtures. The method of locating and clamping them

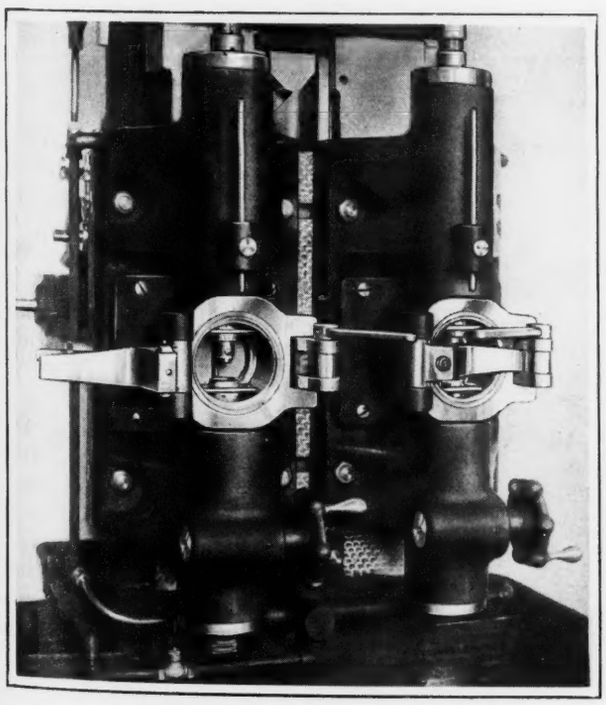


Fig. 1. Diamond-boring the Piston-pin Holes of Two Automobile Pistons

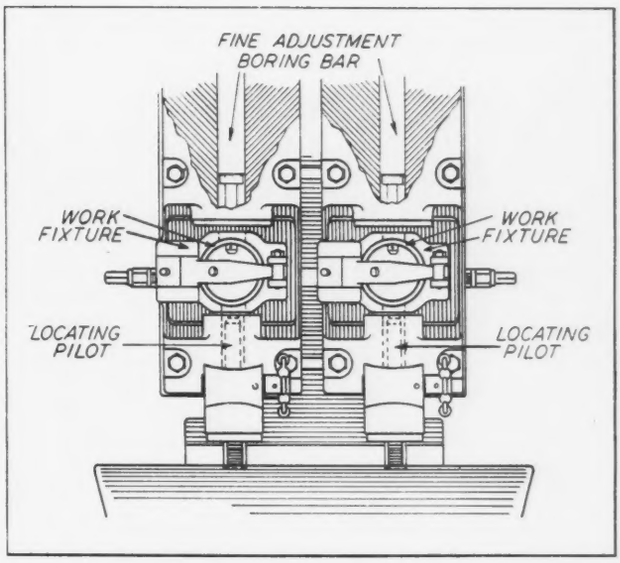


Fig. 2. Method of Locating and Clamping the Pistons in the Fixtures

will be apparent from Fig. 2. It will be noted that the boring-bars are provided with means for making fine adjustments.

In Fig. 1 the clamp of the left-hand fixture is thrown back to give a clear view of the operation. It will be seen that the diamond tool has completed the boring of the upper piston-pin hole and is approaching the lower hole. The diameter of each piston-pin bore is held to 0.9375 inch within limits of 0.0002 inch. The length of each bore is also 0.9375 inch, the gap between bores being 1.500 inches. The depth of cut is 0.004 inch, and the feed 0.0010 inch per revolution, the tool-spindles turning at the rate of 4000 revolutions per minute. The chucking time for the pistons is 20 seconds, and the machine cycle, 60 seconds, giving a total floor-to-floor time of 80 seconds for two pistons.

The principal advantages claimed for this method of finishing piston-pin holes are accurate hole diameters, true alignment of the holes, uniform centering, and easy assembly or replacement due to the absence of taper and out-of-roundness. It is also stated that varying degrees of hardness and differences in composition of the aluminum alloys from which the pistons are made have no effect on the efficiency of the diamond tools, if properly selected.

* * *

FIFTIETH ANNIVERSARY OF THE CLEVELAND ENGINEERING SOCIETY

On March 14 and 15, the Cleveland Engineering Society will celebrate the fiftieth anniversary of its founding. The celebration will be held at the Hotel Hollenden, Cleveland, Ohio, where headquarters will be established for a two-day gathering, to which all engineers, particularly those of Ohio and neighboring states, are cordially invited. Inspection trips to ten plants and engineering projects in Cleveland and vicinity have been planned. A banquet at the Hotel Hollenden on Saturday evening, March 15, will close the celebration.

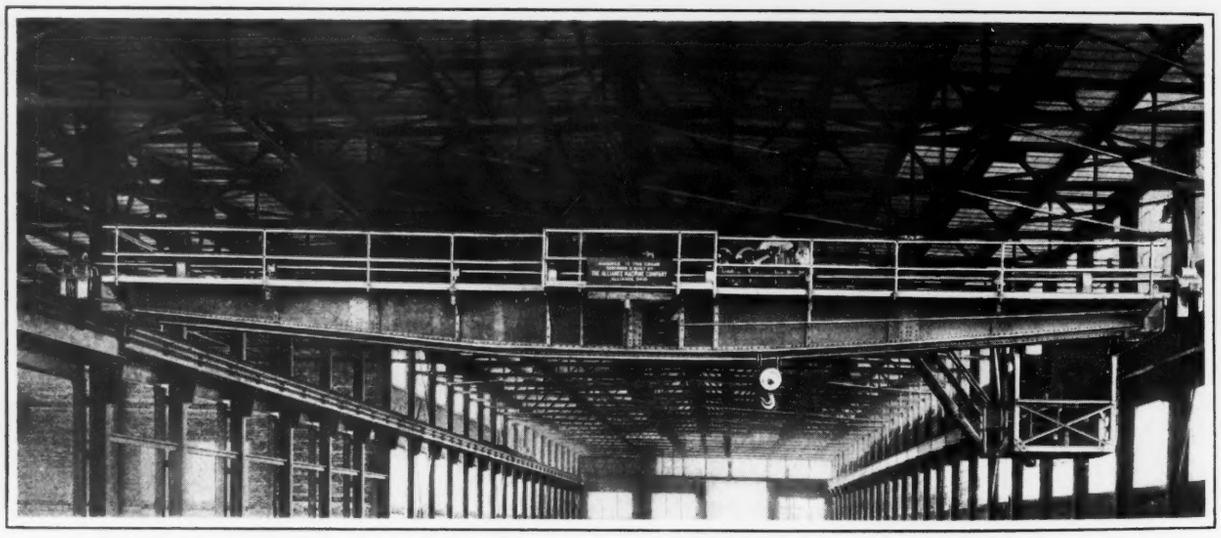
TEN-TON CRANE CONSTRUCTED FROM ALUMINUM ALLOY

Aluminum alloys of high strength have reached such an advanced stage in their development that they are now applied to the main load carrying members of traveling cranes. The illustration shows a 10-ton crane recently built, having a span of over 72 feet, in which the double web girders, walkway, hand-rails, and operator's cage are all constructed of this alloy.

This is the largest structural application today, with the exception of the framework for lighter-than-air craft. By substituting aluminum alloy for steel in this crane, a total weight of 12 tons was saved—mostly in the girders. This is no small item when the saving of power used in overcoming inertia due to starting and stopping is considered.

In a report submitted by F. V. Hartman and E. C. Hartmann of the Aluminum Co. of America, it is mentioned that under a load of 34,500 pounds, the deflection of the crane girders was 1.09 inches, this load, however, being 72.5 per cent over the rated capacity. No measurable permanent set was evident on the removal of the load, and a strain-gage reading taken at the center of the span, indicated no stresses exceeding those computed by ordinary formulas.

The design of this crane is based on the usual practice followed in constructing steel cranes, although certain departures were necessary in the case of the girders, since aluminum alloys and steel differ in some of their mechanical properties. While the strength of structural steel and of heat-treated aluminum alloys is approximately the same, the modulus of elasticity of the latter is only about one-third that of steel. To offset this, the aluminum girders were reinforced and designed with a greater cross-section. They were also given twice the camber ordinarily required on steel girders. In riveting the girders, special precautions were taken not to heat the rivets excessively, as this would have injured the alloy.



By Substituting Aluminum for Steel this Crane was Made 12 Tons Lighter

REPRESENTATIVES OF MACHINERY ASSOCIATIONS MEET

The fifth conference of representatives of machinery and equipment associations was held in the Chamber of Commerce of the United States Building, Washington, D. C., February 3. About thirty representatives of trade associations were present in addition to a number of the officers of the Chamber of Commerce and editors of trade and industrial journals.

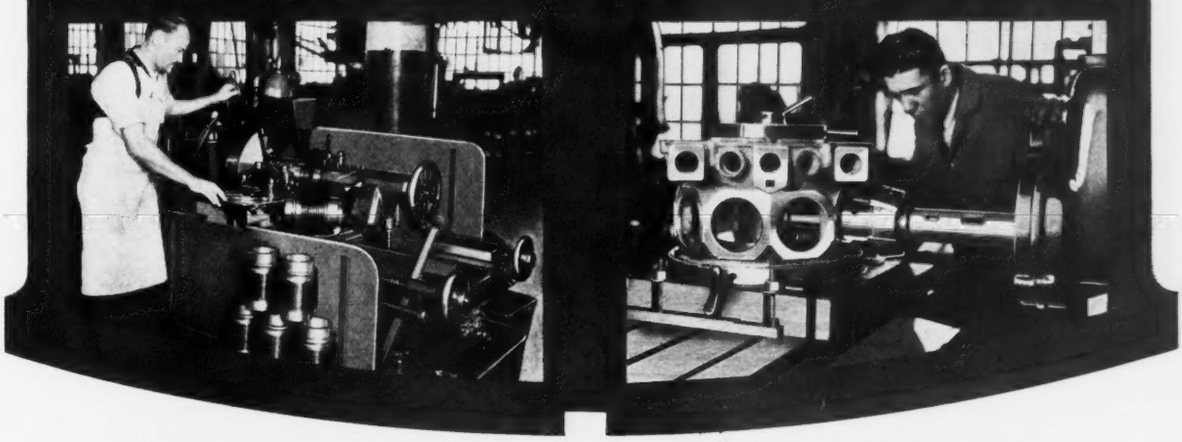
Many subjects of general interest to machine manufacturers in all lines were discussed. Among the subjects dealt with were methods for controlling the "trading in" of old equipment, uniform cost accounting, the establishment of normal depreciation rates, time sales, industrial statistics, and the establishment of "firm" bids.

A committee was appointed to study the needs for a federation of the associations in the machinery and equipment field, and to take steps toward the formation of such a federation, if the conditions seemed to warrant it. The consensus of opinion was that such a federation could be of great service to the machinery-building industries in general. So many of the problems of manufacturers in the machinery industry are identical, and could be dealt with more effectively by a larger inclusive organization than by each individual trade association.

* * *

An interesting tool has been brought out by the Paasche Airbrush Co., 1909-1923 Diversey Parkway, Chicago, Ill., which is known as a universal striper. This tool makes it possible conveniently to paint stripes on machinery or appliances with lacquer, paint, enamel, aluminum bronze, or other striping fluids and finishing materials. The appliance, which has a container for carrying the striping material attached right to the tool, is provided with an adjustable guide that can be set to guide the striper along any surface parallel to that on which the stripe is to be painted.

New Shop Equipment



A Monthly Record of the Latest Developments in Metal-working Machinery, Small Tools, and Work-handling Appliances

NATIONAL-CLEVELAND SPUR AND HELICAL GEAR GRINDING MACHINE

A gear tooth grinding machine adapted for both spur and helical gears is being introduced on the market by the National Tool Co., Madison Ave. at W. 112th St., Cleveland, Ohio, for use in the production of automobile transmission and similar gears. This machine is built in two sizes. The 4-inch size will grind gears up to 6 inches pitch diameter and of 3 diametral pitch or finer, while the 8-inch size will accommodate gears up to 12 inches pitch diameter and of 1 diametral pitch or finer. The 4-inch size is shown in Figs. 1 and 2.

Like the spur gear grinding machine built by this concern, which was described in June,

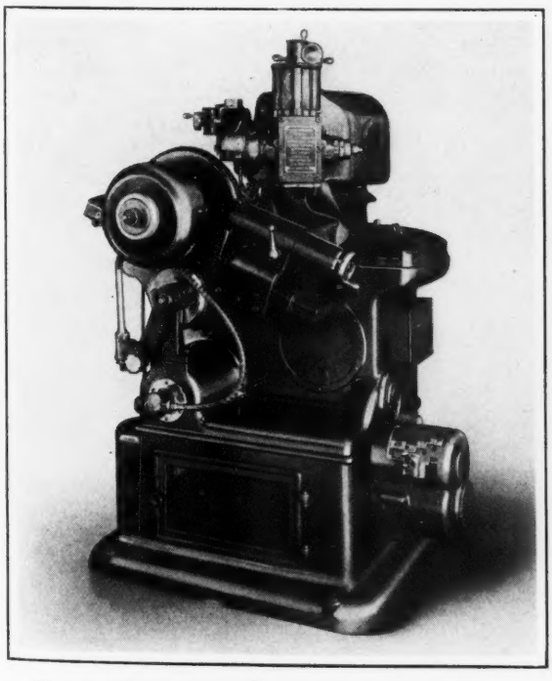


Fig. 1. Front View of National-Cleveland Gear Grinding Machine for Spur and Helical Gears

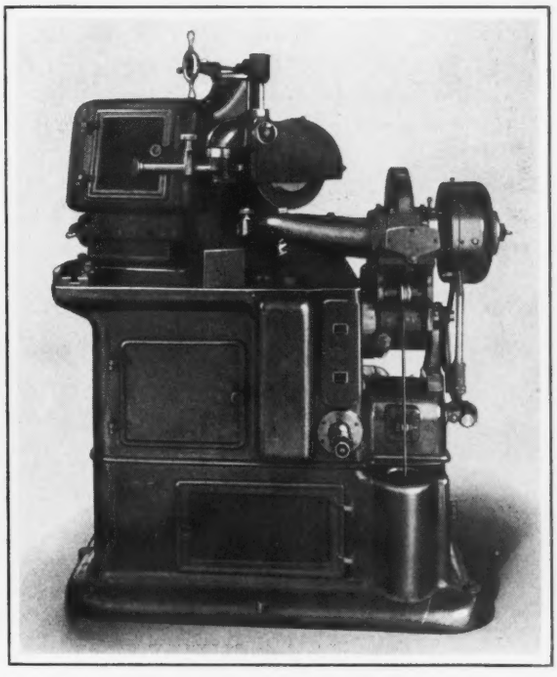


Fig. 2. View of Working Side of the Spur and Helical Gear Grinding Machine

1928, MACHINERY, page 806, and April, 1926, MACHINERY, page 623, the new machine is automatic in operation. It is entirely self-contained, being driven by motors located in the base, and is provided with a snap switch control located on the working side of the machine, as illustrated in Fig. 2. Gears of any helical angle up to 45 degrees, either right- or left-hand, can be ground, the necessary settings for different helical angles being conveniently made through graduations. The machine is regularly furnished for grinding gears to any pressure angle from 0 to 30 degrees; the proper angle can be ground by simply adjusting a swivel to set the slide correctly.

Four speeds of operation, namely, 32, 50, 70, and 100 strokes per minute, are available through the tumbler gear-box. Indexing from tooth to tooth occurs automatically at the end of each return stroke.

Fig. 3 shows the Model B gear checking machine which has been improved to give direct readings to 0.0001 inch with a one-to-one lever arm. This lever arm is mounted on ball bearings with a view to making it frictionless. Ball bearings are also provided for the spindle that carries the work and the base circle disks. The slide of the checking machine now rests in one vertical V-guide and on a flat plane so as to reduce friction to a minimum.

It has been found that in using this machine for checking gears, gear shaper cutters, etc., repeated readings on the same tooth may be made without the necessity of resetting the dial of the indicator, the same reading being obtained in each case. In addition to checking involute curves, this machine has been adapted to checking the concentricity of the involute curved tooth with the bore of the cutter, by checking through an arc of 180 degrees. The machine is also arranged for checking the interspacing of the teeth. It is made in 6- and 8-inch sizes.

GLOBE AUTOMATIC MULTIPLE-SPINDLE TAPPING MACHINE

Any number of spindles up to ten can be employed simultaneously on a tapping machine recently developed by the Globe Tapping Machine Co., 488 John St., Bridgeport, Conn., for the high-production tapping of a wide variety of pieces. Except for the loading of the work carrier, the machine is entirely automatic. Light drilling, countersinking, screwdriving, staking, light forming, horizontal reaming, and other operations may also be performed through the use of attachments.

Four 3/8-inch standard taps can be used at one time in tapping pieces made of 1/4-inch steel; on lighter material the machine has a capacity for using ten No. 10–32 taps at a time. Pieces up to 6 by 12 inches and up to 3/8 inch thick can be handled.

The machine is similar to a former model built by the concern, except that it is designed to use ten spindles, has the driving motor located in the base, and is equipped with a clutch-type driving pulley, the clutch being engaged and disengaged by a foot-treadle. An automatic

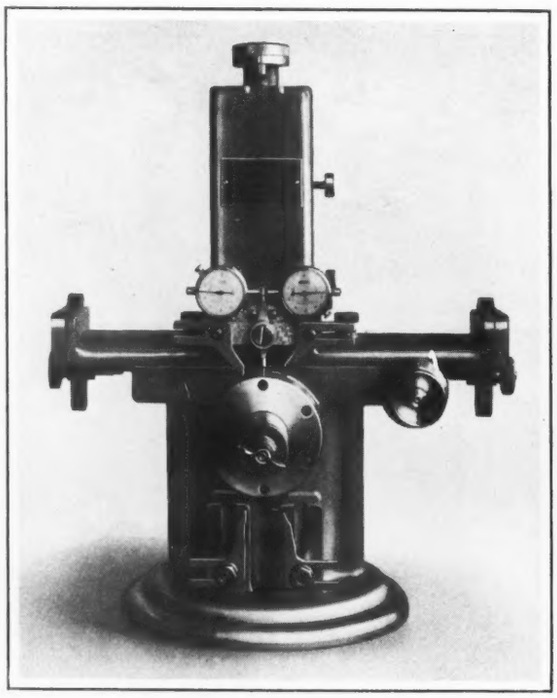
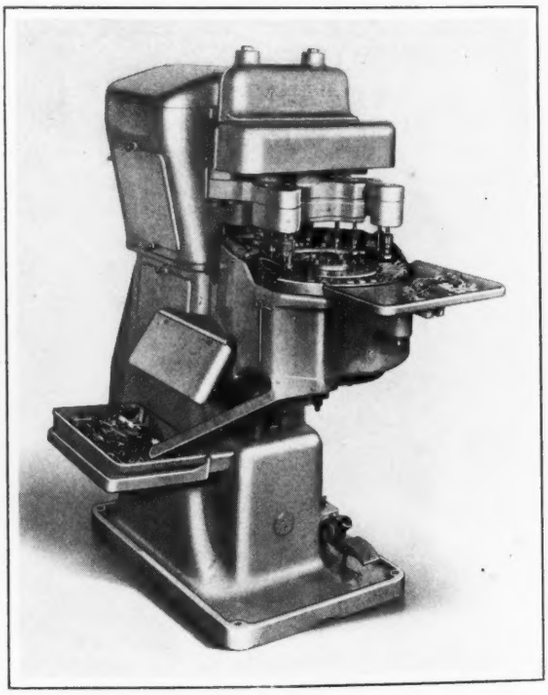


Fig. 3. Gear Checking Machine which Gives Direct Readings in Ten-thousandths of an Inch



Globe Automatic Tapping Machine Equipped with Ten Spindles

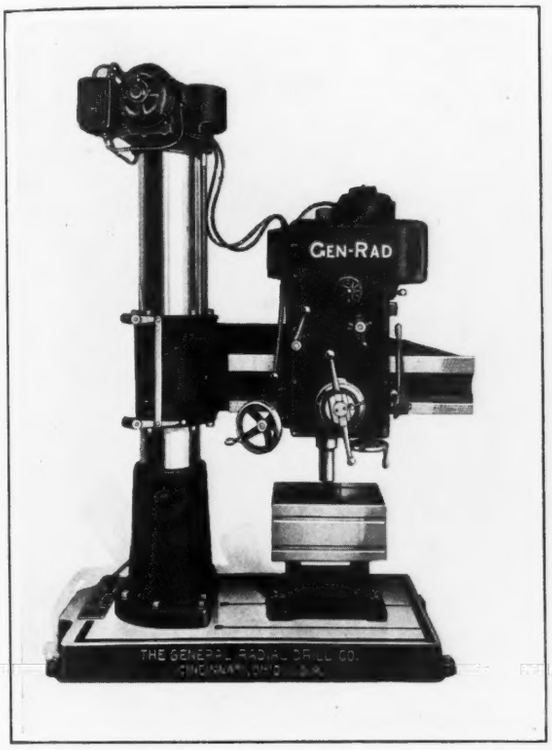


Fig. 1. "Gen-Rad" Radial Drilling Machine with Gibbs V-disk Speed Transmission

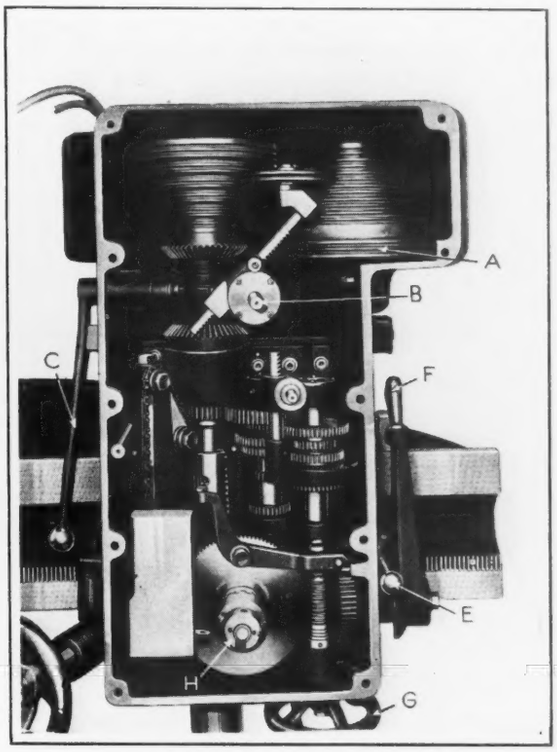


Fig. 2. Gibbs V-disk Transmission and Spindle Feed Mechanism

tripping mechanism has also been added. This member connects with the clutch and stops the machine automatically in case the indexing of the work carrier should be interfered with. In this way, it serves to protect the feeding mechanism and the taps.

The driving motor, which is either of 1 or 2 horsepower and has a speed of 1750 revolutions per minute, is mounted on a tilting plate in the base of the machine. Means are provided for adjusting the belt tension. The spindles can be adjusted as to location. They are so arranged that each tap follows its own lead, permitting the use of taps of different sizes on the same machine.

Indexing of the work carrier, as well as lifting of the tapping head, is accomplished by cam action. Indexing is usually performed at the rate of 30 cycles per minute; by doubling or tripling the number of spindles, sixty or ninety pieces can be finished per minute. Dial, conveyor- and push- or drum-feed types of work carriers can be furnished. A suitable hopper for feeding the pieces to the work carrier can also be supplied.

"GEN-RAD" AND "HY-RAD" RADIAL DRILLING MACHINES

Two lines of radial drilling machines are being introduced on the market by the General Radial Drill Co., Cincinnati, Ohio, under the trade names of "Gen-Rad" and "Hy-Rad." The first mentioned is illustrated in Fig. 1. This is a general-purpose machine having a capacity for twist drills from 0 to 2 inches in diameter. It is built in two sizes with column diameters of 9 and 11 inches, respectively, and with arms 3 and 4 feet long.

The "Hy-Rad" machine, which is illustrated in Figs. 3 and 4, is provided with hydraulic equipment for feeding the spindle, traversing the head on the arm, and clamping the arm to the column. This machine is built in column diameters of 15, 17, and 19 inches, with arms from 4 to 8 feet long.

Electric power is delivered to the "Gen-Rad" drilling machine through a revolving connection in the column base. Brushes in contact with rings in this connection are wired through an iron conduit secured to the cap at the top of the column. In this way, provision is made for maintaining the connection as the cap on the column swings with the arm.

From Fig. 1 it will be seen that there is a motor at the top of the column for raising and lowering the arm, while a second motor on top of the head drives the spindle and the feed mechanism. Raising and lowering of the arm are accomplished by means of worm-gearing. The worm-wheel is engaged by a positive clutch keyed to the elevating screw. This clutch constitutes a safety device, the arrangement being such that if the downward movement of the arm should be blocked, the screw would continue to revolve, thereby lifting

the clutch out of engagement with the worm-wheel and disconnecting the power.

The column consists of an inner and outer tube cast integral with web connections. The inner tube provides space for the electric wiring. The barrel on the arm is not split and completely surrounds a sleeve which is a slip fit on the column. Ball bearings at the top and bottom of this sleeve facilitate the rotation of the arm and barrel around the sleeve and column. Clamping of the arm to the column is accomplished through split rings at the top and bottom of the barrel.

From the motor mounted on the top of the head, power is transmitted to the Gibbs V-disk transmission illustrated in Fig. 2. This drive eliminates the necessity of speed-change gears. A disk mounted on the motor spindle engages the lower disk *A*. By changing the position of the idler between the two sheaves, twelve different speeds can be obtained, and by changing the diameters of the sheave steps, these twelve speeds can be obtained in different ranges from 78 to 3000 revolutions per minute. The idler is drawn out of engagement with the sheaves by pulling forward the star-wheel on the front of the drill head, the star-wheel being attached to shaft *B*. By turning the star-wheel to bring an arrow into position to indicate the desired speed, the idler is made ready to engage the required steps on the sheaves when the star-wheel is pushed back.

From the driven sheave, power is transmitted through bevel gears between which a clutch is placed that is operated by lever *C*. This provides for obtaining forward and reversing movements as required in tapping operations. Power is carried to the feed mechanism through a pair of gears. Sliding gears provide seven changes of feed ranging from 0.006 to 0.037 inch per revolution of the spindle. The power feed is engaged through lever *E*. For the performance of sensitive drilling operations, this clutch can be disengaged and the spindle fed by hand through lever *F*. The drill is advanced to the work, ready to start feeding, by means of handwheel *G*. Rapid adjustments of the spindle position are accomplished through hand-levers on shaft *H*.

Push-button controls on the head govern the action of both motors. Thus it will be apparent that all controls are centralized on the head within easy reach of the operator.

The design of the "Hy-Rad" radial drilling machine illustrated in Figs. 3 and 4 follows that of the "Gen-Rad" machine with regard to the swivel electric connection in the column base, the column construction, the provision for raising and lowering the arm, the design of the barrel, and the means of clamping the arm. However, the clamping of the arm is accomplished hydraulically on this machine, as previously mentioned.

The principal advantages claimed for the hydraulic spindle feed are greater uniformity of the feeding movement and greater flexibility and control of the feed; thus an unlimited range of feeds is available and it is possible to adjust the feed to compensate for variations in the hardness of the material being

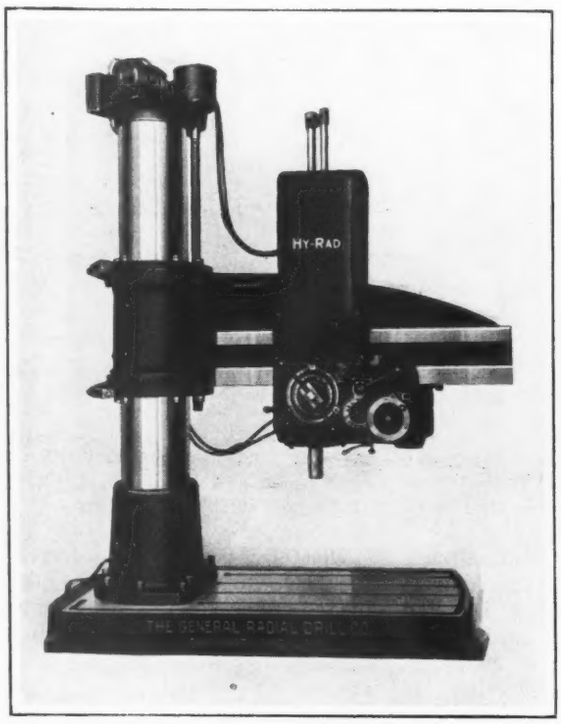


Fig. 3. Radial Drilling Machine with Hydraulic Equipment for Feeding the Spindle, Traversing the Head, and Clamping the Arm

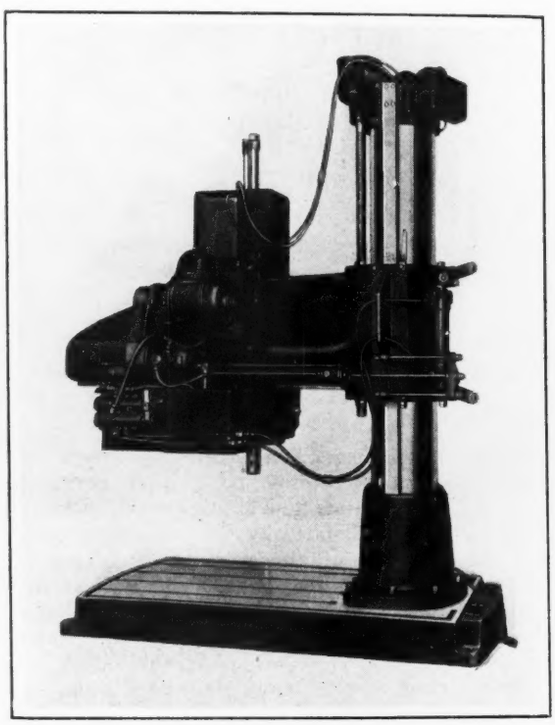


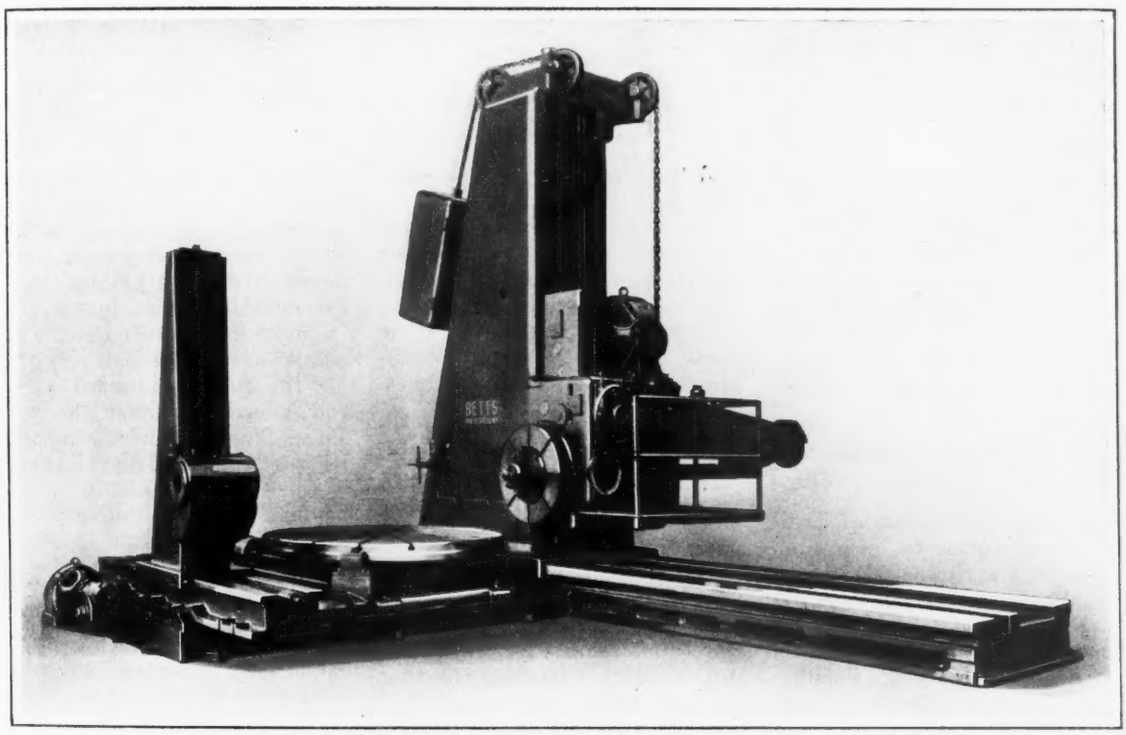
Fig. 4. Rear View of the "Hy-Rad" Radial Drilling Machine, Showing the Hydraulic Equipment on the Back of the Head

drilled. An electric motor mounted on the back of the drilling head, as shown in Fig. 4, drives the pump that furnishes the hydraulic pressure and also drives the speed change gears. Twelve spindle speeds are obtainable through the sliding change-gears and any of these speeds can be multiplied by selective gearing on the spindle, thus making twenty-four speeds available. On the machine illustrated the range of spindle speeds is from 20 to 1058 revolutions per minute, but other ranges can be supplied.

The piston employed for feeding the spindle hydraulically is mounted at the top of the spindle and is free to rotate on antifriction bearings. By moving a lever at the bottom of the drilling head to the left of the neutral position, pressure is applied for feeding the spindle downward, and moving the lever to the right causes the spindle to be moved upward. The rate of feed is set by means of a starwheel and a dial indicator. Feeds ranging from 0 to 100 inches per minute are available hydraulically. The spindle can also be moved up or down by hand.

A valve on the rear of the drilling head is operated to traverse the head along the arm in either direction. This traverse is also controlled by means of a lever on the head. The cylinder used for this purpose is secured to the head and moves with it, while the piston-rod is held by a bracket mounted on the barrel that surrounds the column. A second valve on the rear of the head controls the admission of oil into a cylinder having a piston-rod connected to toggles that actuate the upper clamping ring. The cylinder itself is connected to a similar toggle on the lower clamping ring. When the oil is admitted to the cylinder, the piston-rod is moved up and the cylinder down, thereby actuating both toggles and locking the barrel to the column. The valve of this cylinder is also controlled by a lever located on the head.

Two push-button controls on the front of the head govern the electric motor at the top of the column that raises and lowers the arm and the electric motor that drives the hydraulic pump and spindle transmission gears. Thus all control mechanism of this machine is also located centrally on the head.



Betts Floor-type Boring, Drilling, and Milling Machine with Spindle-drive Motor on Saddle

BETTS HORIZONTAL BORING, DRILLING AND MILLING MACHINE

On the Betts 7-inch floor-type boring, drilling, and milling machine built by the Consolidated Machine Tool Corporation of America, Rochester, N. Y., a variable-speed motor mounted on the saddle is used solely for driving the spindle. A separate variable-speed motor provides the milling feed and the power rapid traverse for the saddle and column. In addition, separate motors are provided for moving the circular table toward and away from the column runway and for driving the table. This arrangement of separate motors provides a wide range of speeds and feeds without complicated gearing. The spindle is driven at slow speeds through a steel faceplate gear.

The machine is regularly furnished with a large floor plate of heavy box construction. A circular table may also be supplied, as illustrated. The steadyrest is mounted on a separate carriage and can be bolted to the floor plate or used on the runway of the circular table. It can be adjusted rapidly on the runway by hand, and the boring-bar bearing can be adjusted vertically on the column by hand.

The column is provided with a graduated scale for accurate adjustments, with taper shoes for taking up wear, and with the standard Betts type narrow guide for the saddle. The motor that provides the milling feed and power travel of the column and saddle is located on a shelf at the base of the column. The saddle has a vertical travel of 10 feet. It is provided with a platform for the operator, which facilitates operation of the various controls. A Farval one-shot centralized lubricating system insures an ample supply of lubricant to every vital part, with minimum attention.

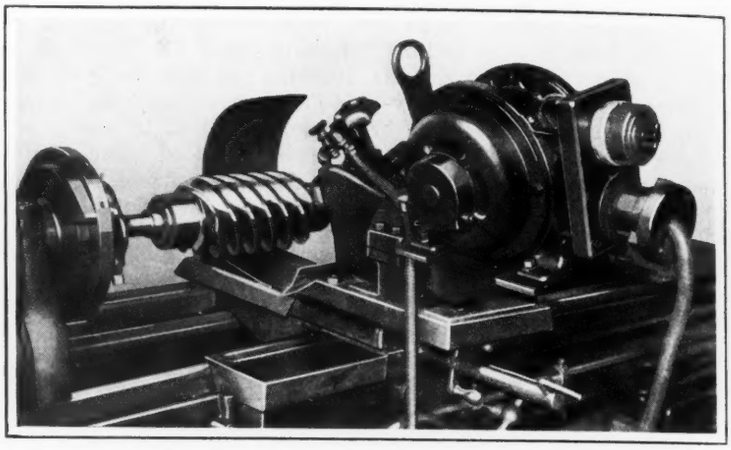


Fig. 2. Another View of the Worm-grinding Attachment Showing the Index Faceplate

Eight feeds are available for boring and drilling, and threads of four different leads can be cut. For milling, a wide range of feeds is obtainable through the variable-speed motor and supplementary mechanical changes.

NEWARK WORM-GRINDING ATTACHMENT FOR LATHES

To enable the threads of hardened steel worms to be ground in a lathe, the Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J., has placed on the market the attachment shown in the accompanying illustrations. This attachment is designed for grinding worms from 1 inch in diameter up to the largest size that can be swung on the lathe on which the attachment is used.

The grinding operation is performed by first taking a cut along the thread, reversing the countershaft for returning to the starting position, feeding sidewise by means of the feed slide of the attachment, and then taking another cut. This procedure is repeated until the worm is ground to the finished size.

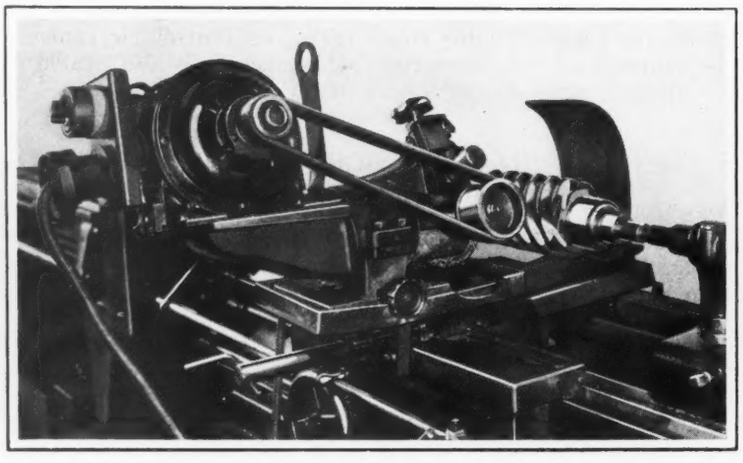
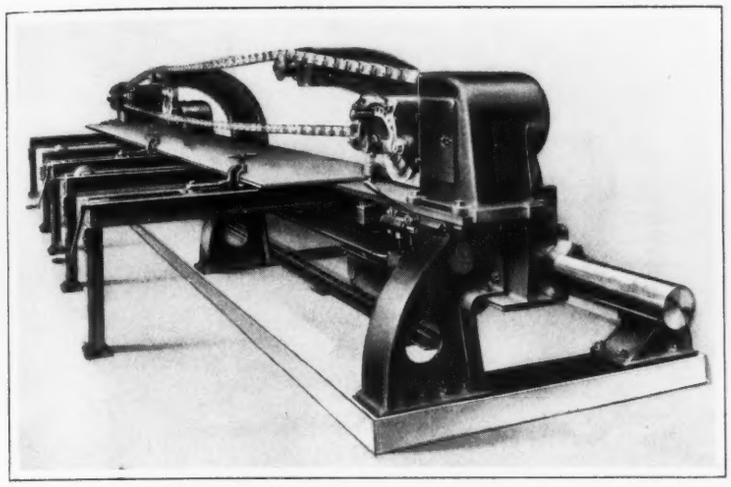


Fig. 1. Lathe Attachment for Grinding the Threads of Hardened Steel Worms

On reversing the countershaft, the worm is automatically relieved of the cutting pressure of the grinding wheel by the play in the change-gears. Usually one side of a worm thread is finished and the work then turned end for end in order to finish the other side. This procedure is followed in order to secure a symmetrical worm. In the case of worms having left-hand threads, the cone belt of the lathe is crossed or the lathe is reversed.

Grinding wheels of the disk form, either 8 or 10 inches in diameter with a 1-inch hole, are employed. Threads of any depth up to 1 1/2 inches may be ground with an 8-inch wheel, while threads up to a depth of 2 1/2 inches may be ground with a 10-inch wheel. The depth of the worm thread is controlled by the feed-screw of the lathe cross-slide. The spindle is mounted in Timken tapered roller bearings and is adjustable for the helix and the pressure angles. A diamond dressing device is mounted on the wheel-head.

An indexing faceplate with notches, for use in grinding multiple-thread worms, can be furnished if desired, as shown in Fig. 2. The one-horsepower motor which drives the grinding wheel is of the ball bearing type and runs at a speed of 3600 revolutions per minute. Changes in the spindle speed are obtained by means of two sets of pulleys



Trimming and Beveling Shear with an Upper Rotary Knife and Lower Stationary Blade

furnished with the attachment. The lead capacity depends upon the lathe lead-screw. This attachment is suitable for 16-, 18-, or 20-inch lathes, but is most frequently used on the 18-inch size.

ROTARY KNIFE SHEARS FOR TRIMMING AND BEVELING PLATES

A rotary upper knife and a stationary lower blade or knife perform the cutting operations on a line of plate slitting, trimming, and beveling shears manufactured by Schulze & Naumann, Koethen, Anhalt, Germany. The rotary knife, as shown in the illustration, is supported on a carriage that is motor-driven through a block chain which engages the teeth of spur gears. The plate is cut by the rotary upper knife acting against the stationary lower blade as the carriage is traversed from one side of the machine to the other. The carriage is automatically disengaged at the end of its travel in either direction.

The rotary knives used for straight cutting or trimming can be replaced in two or three minutes with a rotary knife inclined at an angle so as to cut plates to the proper bevel for welding. The bevel cuts are taken with the plates lying flat. A suitable knife with a guide and shaft is necessary for each bevel. Knives with an 18-degree angle for beveling and with a 30-degree angle for scarfing are available, and knives with larger angles up to 40 degrees can be furnished.

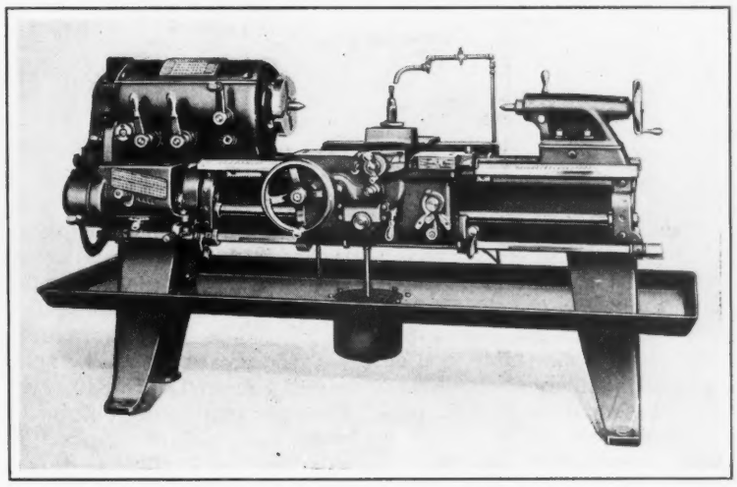
These shears are made in three different models. One model is of a throatless type and will take a cut of the same length as the lower stationary blade. Another model has throated housings, and is designed to cut either across or lengthwise of the plate. With this model any length of cut can be made in cutting off pieces of any width which does not exceed the throat depth. The model shown in the illustration is designed primarily for trimming, and the rotary knife is mounted on a carriage having a throat. The width of cut is limited to the depth of the carriage throat.

The shears are made in various sizes, the smallest size being designed to handle plates up to 1/8 inch thick, while the largest size will cut plates 1 3/16 inches thick. It is claimed that a steel plate 1 3/16 inches thick and 160 inches wide can be cut off in twenty-five seconds.

REED-PRENTICE HIGH-SPEED LATHES

Modification of the "New Model" sliding gear head lathes built by the Reed-Prentice Corporation, Worcester, Mass., have recently been brought out in the 14- and 16-inch sizes. These modified lathes are adapted to plain turning, boring, and facing operations with high-speed steel tools by using the standard spindle speeds of from 18 to 432 revolutions per minute, and with tungsten-carbide tools by employing speeds of from 52 to 1250 revolutions per minute.

It is stated that in rigidity tests performed in the 14-inch lathe equipped with a 15-horsepower motor, an iron casting 2 1/2 inches in diameter, running at 825 revolutions per minute, was machined at the rate of 23 inches per minute with a cut



Reed-Prentice Production Lathe with Spindle Speeds Suitable for High-speed Steel or Tungsten-carbide Tools

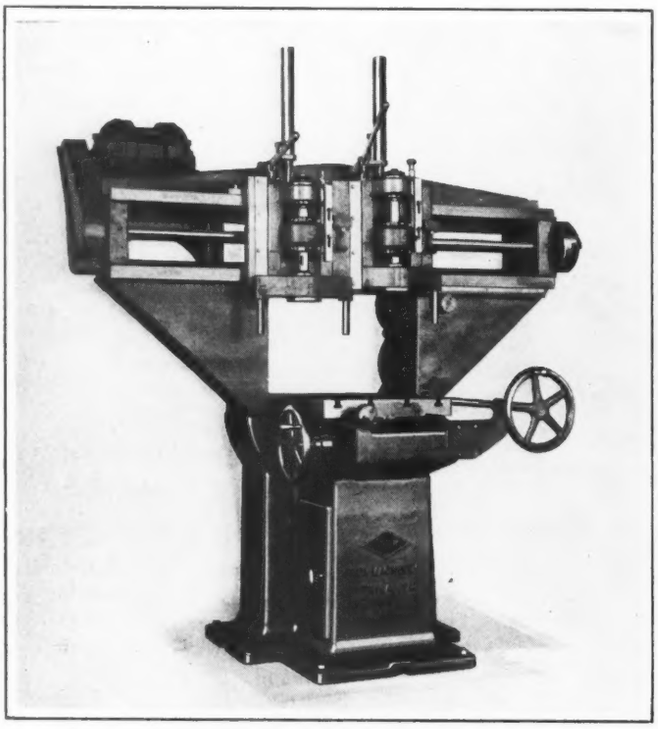


Fig. 1. Frew Two-spindle Profiling Machine with Spiral Gear Drive

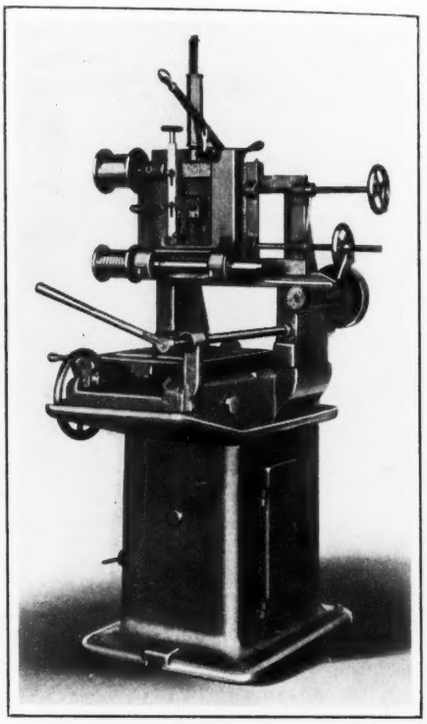


Fig. 2. Frew Horizontal-spindle Machine for Profiling Soft Materials

1/4 inch deep and a feed of 0.028 inch. Steel of S.A.E. 1020 specification, 4 1/2 inches in diameter, running at 219 revolutions per minute, was machined at the rate of 8.25 inches per minute, the depth of cut being 1/4 inch and the feed 0.038 inch.

The main difference between these lathes and the standard engine lathes built by this concern is in the absence of the lead-screw members, the machines not being intended for screw-cutting operations. Also, a plain rest is supplied instead of a compound rest. Various combinations of tooling are available for rapid production, including such devices as a cam-lever tailstock and front and rear connected rests with multiple-type toolholders. The spindle runs in Timken tapered roller bearings.

FREW PROFILING MACHINES

A No. 6 two-spindle machine, designed for milling irregular shapes and for regular vertical milling operations, and a No. 3 horizontal-spindle machine intended for profiling operations on wood, fiber or other soft materials requiring high cutting speeds, have recently been brought out by the Frew Machine Co., 132 W. Venango St., Philadelphia, Pa. Guide pins on the spindle slides of the No. 6 machine, shown in Fig. 1, permit duplicating the profile of a master form set up on the fixture. One of the spindles has an extra guide pin for use in making a master former by placing a sample piece in the work position.

The spindles have a cross movement of 42 inches, controlled by a handwheel at the front of the machine, and a vertical movement of 4 inches, controlled by hand-levers. Backlash in the gear trains of the table and spindle feeds is taken up by employing a split construction for the gears. Spindle speeds ranging from 150 to 840 revolutions per minute are obtained by means of pick-off gears. The spindles run in Timken tapered roller bearings and the end thrust is taken by ball thrust bearings. Hardened and ground spiral gears are employed for the spindle drives.

There is a clearance between the uprights of 25 1/2 inches, and the cross-slide is located at a height of 11 1/4 inches above the table. This height, however, can be increased to meet requirements. The machine occupies a floor space of 48 by 82 inches and weighs 4000 pounds.

The No. 3 horizontal profiling machine is shown in Fig. 2. The ball-bearing spindle of a belt-driven machine runs at about 4500 revolutions per minute. Machines furnished with a direct motor drive have a speed of 3600 revolutions per minute on 60-cycle current, which can be increased by means of a frequency changer to give a speed of 7200 revolutions per minute on a 120-cycle circuit.

The spindle is mounted in a spring-counterbalanced slide which is raised and lowered by a hand-lever, while the cross movement of the spindle on the rail is also effected by a hand-lever. A handwheel at the side of the bed controls the table movement. Backlash in the table- and spindle-feeding mechanism is taken up by employing "double-

cut" gears and eccentric bearings. The spindle slide has a cross movement of 3 inches and a vertical movement of 3 3/4 inches. The distance between the machine uprights is 16 inches; and the movement of the table, 15 1/2 inches.

LANGELIER SEMI-AUTOMATIC FIVE-WAY DRILLING MACHINE

Five holes are drilled simultaneously in valve tappet guides in a semi-automatic single-purpose machine developed recently by the Langelier Mfg. Co., Providence, R. I. The piece to be drilled is simply clamped in its fixture and the foot-operated control lever pressed down. This causes all five drills to come into operation, return to the starting position, and stop. The drilled piece is then replaced by another piece of work and the operation repeated at a production rate of approximately ten pieces per minute.

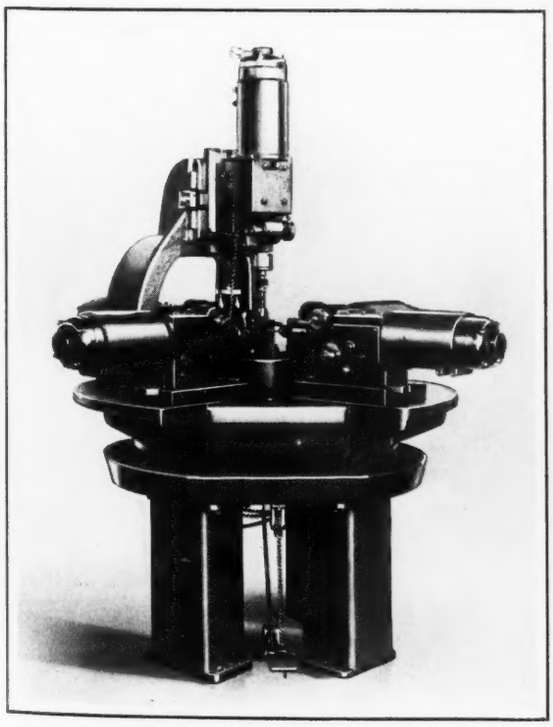
Two work-holding fixtures are supplied with the machine for drilling two different types of valve tappet guides. These fixtures are interchangeable, and provision is made for locating them accurately on the machine, which is composed of five No. 11 automatic self-feeding drilling units arranged on a base as shown.

The four units located radially in a horizontal position are spaced 90 degrees apart. The vertical unit is mounted on a double cross-slide to provide the adjustment required when changing from one piece of work to the other. One of the slides provides vertical adjustment for bringing the drill into the proper working position, and the other permits the drill to be adjusted horizontally.

One of the valve tappet guides drilled on the machine is made of brass and has an outside diameter of 1 inch, a length of 4 1/2 inches, and a wall thickness of 1/8 inch. The four cross-holes spaced 90 degrees apart are drilled through the wall of the tubular portion of the work. Two diametrically opposite holes in this group are 0.159 inch in diameter while the other two holes are 7/32 inch in diameter. The fifth hole, produced by the vertical unit, is drilled parallel with the axis of the work at a distance of 13/16 inch from the center. The machine occupies a floor space of 56 by 56 inches and weighs about 3000 pounds.

REED-PRENTICE VERTICAL MILLING AND DIE-SINKING MACHINE

Various improvements recently incorporated in the No. 3 vertical milling and die-sinking machine built by the Reed-Prentice Corporation, Worcester, Mass., include the mounting of the longitudinal feed-screw in Timken tapered roller bearings, as illustrated in Fig. 2. These bearings have been provided to take all thrust and radial loads. Another new feature is the provision of a handle at the front right-hand end of the table through which a hand-feed at a 1 to 1 ratio is available. This



Langelier Semi-automatic Machine for Drilling Five Holes in Valve Tappet Guides

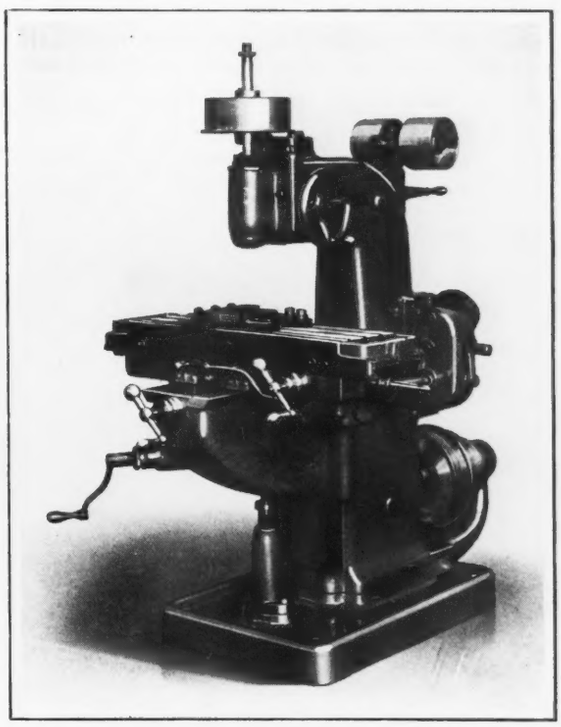


Fig. 1. Reed-Prentice Improved Vertical Milling and Die-sinking Machine

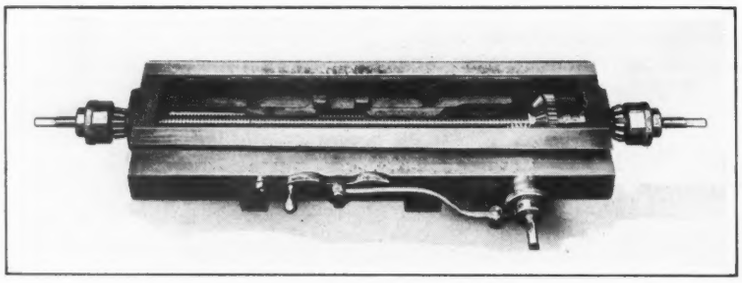


Fig. 2. Saddle Construction in which Timken Bearings are Provided for the Longitudinal Feed-screw

arrangement gives a hand longitudinal feed from the front of the machine as well as from either end of the screw.

The machine is also available with a rotary table of new design. This table has a working surface 16 1/2 inches in diameter and an oil trough. Hand and power feeds are provided. The handwheel for the hand feed is located at the front of the machine instead of at the rear as in past models, and thus provides a centralized control.

The ball-bearing spindle and pulley construction incorporated in the machine permits the use of spindle speeds up to a maximum of 4000 revolutions per minute. This feature was described in detail in an article published in the June, 1929, number of MACHINERY, page 791.

HAMMOND "RITE-SPEED" POLISHING AND BUFFING LATHE

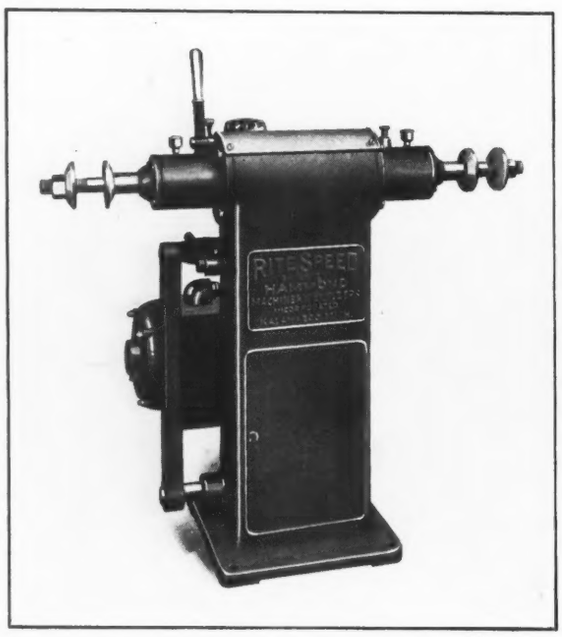
A Type C "Rite-Speed" electric polishing and buffing lathe developed by the Hammond Machinery Builders, Inc., 1604 Douglas Ave., Kalamazoo, Mich., is being placed on the market in a complete range of sizes having capacities from 3 to 15 horsepower. The correct speed for polishing or buffing is obtained by changing the pulley on the motor, which is mounted at the rear of the pedestal. Power is transmitted from the motor to the spindle by a multiple V-belt drive, the tension of which can be adjusted by turning a nut.

A feature of the machine is the ease with which the belts can be changed. By removing four large cap-screws on each side of the spindle, the entire spindle assembly can be removed from the pedestal without disturbing the bearing mounting or sub-assembly parts. The motor adjustment screw can then be loosened to release the tension on the motor pulley, after which the belt can be slipped off the spindle. The motor is totally enclosed and is fitted with an air cleaner which prevents the cooling air from carrying dust into the windings.

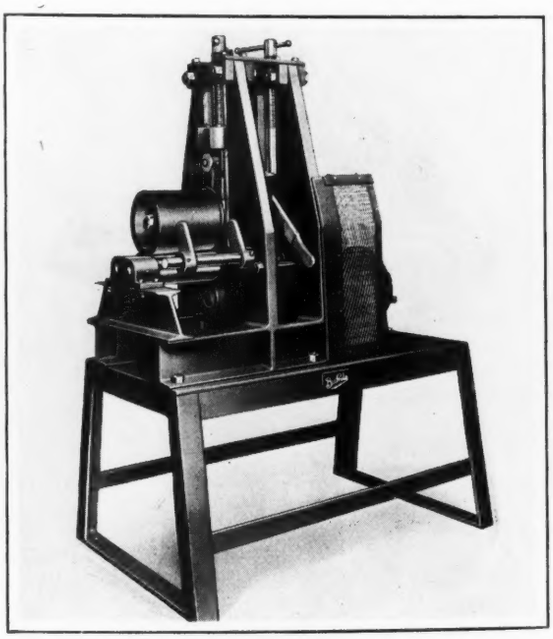
It is claimed that the width of the machine is reduced from 8 to 15 inches by mounting the motor at the rear of the pedestal instead of in the base, without cutting down the working space around the wheels. The spindle is equipped with either Timken tapered roller bearings or ball bearings.

BUFFALO WRAPPING ROLLS

Metal cylinders ranging from 5 to 30 inches in diameter and from 2 1/2 to 30 inches in length can be formed from sheets or



"Rite-Speed" Polishing and Buffing Lathe with Multiple V-belt Drive



Buffalo Wrapping Roll which Forms Metal Cylinders from Sheets or Plates

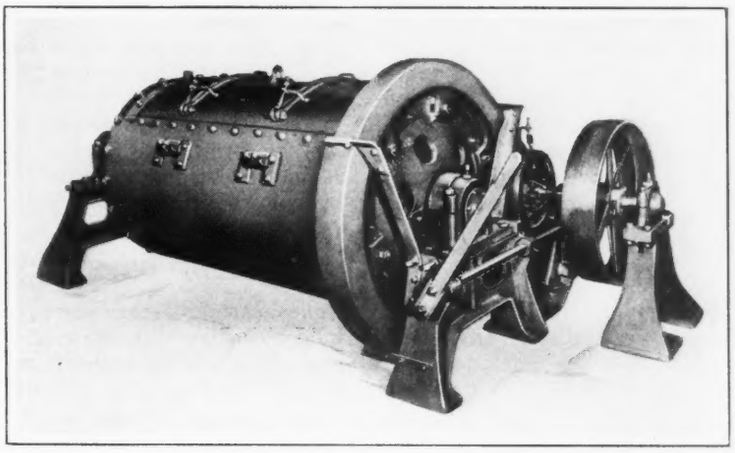
plates by employing a line of wrapping rolls now built by the Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. These machines have been developed as auxiliaries to the line of bending rolls made by the concern, and handle metal ranging in thickness from 1/16 to 1 inch. Not only can plain cylinders be produced, but flanged shapes as well, through the use of special rolls. Rings for small motor frames, automobile rims, steel pulleys, and tractor and trailer wheels are typical products of the machine.

Each cylinder diameter requires a separate master roll, but aside from this change, all other changes are made by means of the twin-screw adjustment at the top of the equipment. A quick-acting work release makes it possible to remove finished cylinders without disturbing the setting of the rolls. Guide fingers assure proper alignment of the material being fed. The three sizes in which these rolls are built weigh 1550, 3000, and 5000 pounds, respectively.

MORTON SHAPER ATTACHMENT FOR MACHINING SPROCKETS

For cutting splines on the hubs of cast-steel "crawler" drive sprockets, the Morton Mfg. Co., East Broadway and Hoyt St., Muskegon Heights, Mich., has recently developed an attachment for use on the 38-inch stroke high-duty draw-cut shapers built by this concern. The attachment is equipped with a rotary feed for circular cutting and can be indexed through a complete circle or 360 degrees.

A special double-cutting head is used which permits one or two tools to be used in shaping the splines on the hub. In the illustration, two tools are shown in position for machining both sides of a spline in one operation. Shapers of the type mentioned are equipped with an auxiliary table; a standard swivel base vise; a shaper head; and a jib crane having a two-speed hoist of one-ton capacity. When not employed for special work such as that described, the machine can be used for general production shaping and planing operations.



Heavy-duty Roller-bearing Tumbling Mill Built by W. W. Sly Mfg. Co.

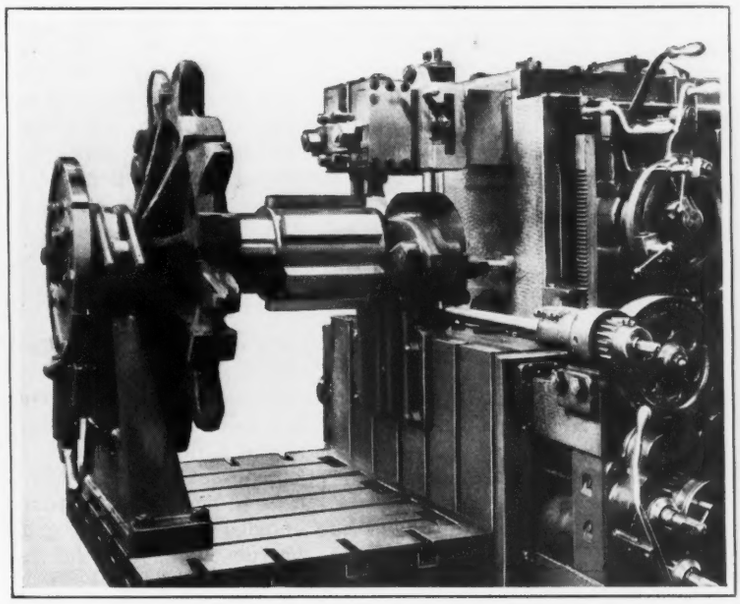
TUMBLING MILL FOR CLEANING CASTINGS AND FORGINGS

Various improvements have been incorporated in the Type C tumbling mill recently brought out by the W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland, Ohio. This equipment has been designed especially for heavy-duty work in the cleaning rooms of foundries and forging shops.

Some of the more important improvements include pressure-lubricated dustproof roller bearings; single-lever control for operating the combination clutch and brake; positive door-locking device designed to permit quick loading and dumping; loading door which extends the full length of the barrel; and Venturi ventilating air passages designed to remove dust and dirt from the work without permitting it to reach the bearings.

SELIK HAMMERED BORING TOOLS AND LATHE CENTERS

A line of boring tools, threading tools, and lathe centers is now made by the Joseph L. Selik Tool Co., 1831 Van Dyke Ave.,



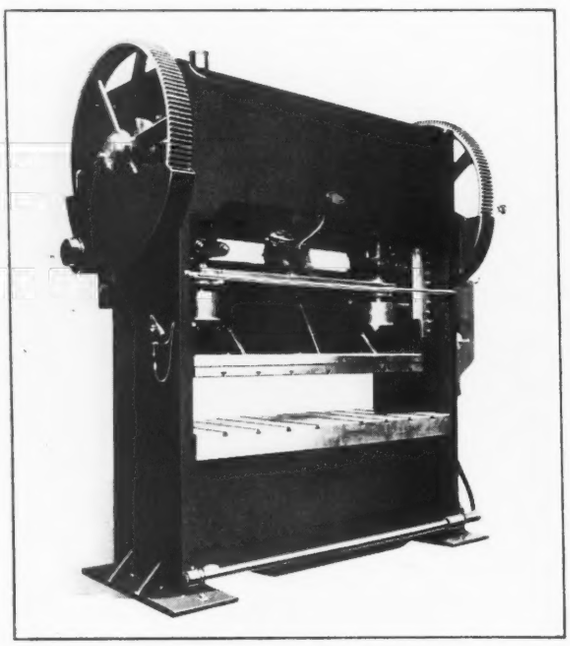
Morton Shaper Attachment for Machining Hubs of Sprockets

Detroit, Mich., in a large range of sizes. The boring tools are made in styles designed for use on various types of machines, including the Swiss jig borer and the Lucas boring mill. They are made of high-speed steel, carefully heated in a selected fuel and hammered. The tools are then ground to shape and hardened, after which they are drawn and sand-blasted.

The lathe centers are made to Morse, Brown & Sharpe, and Jarno tapers, and are obtainable in tool steel or high-speed steel.

VERSON ALL-STEEL STRAIGHT-SIDE PRESSES

A complete line of straight-side power presses of single-, double- or triple-crank type has been added to the line of all-steel presses built by the La Salle Machine Works, Inc., 3013-17 S. La Salle St., Chicago, Ill. The bed, overhead member, uprights, ram and bull gears of these machines are all of steel-plate welded construction. It is claimed that this construction gives strength and rigidity, with minimum bulk and weight. In building the machines, it is possible to incorporate the ideas of the purchaser conveniently and economically, particularly when unusual dimensions are required.



Verson Straight-side Press of All-steel Welded Construction

The heavier machines of this line are equipped with a motor adjustment of the ram, a "Texrope" drive, a "one-shot" lubrication system, bronze-bushed main bearings, Timken roller bearings for the back-shaft and flywheel, and a multiple-disk friction clutch. The back-shaft is provided with shearing pins to prevent damage to a press due to overloads or improper die settings.

BROWN & SHARPE TELESCOPING GAGES AND DEPTH GAGE ATTACHMENT

The No. 590 telescoping gages shown in Fig. 1, designed for use with a micrometer caliper for making internal measurements in places hard to get at, and the No. 468 depth gage attachment shown in Fig. 2 have recently been added to the line of tools made by the Brown & Sharpe Mfg. Co., Providence, R. I.

The set of gages shown in Fig. 1 consists of five heads and a handle on which the heads are interchangeable. The telescoping head is compressed and inserted in the hole or slot to be measured, where the plunger expands until proper contact is made with the surfaces to be gaged. A turn of the knurled screw on the end of the handle then locks the head, after which the gage is removed and measured with a micrometer. The ends of each head are hardened, and the faces are ground to the radius of the smallest hole the gage will enter. Thus the gages are adapted for measuring curved surfaces.

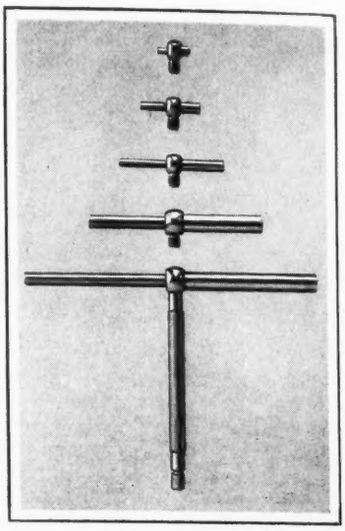


Fig. 1. Brown & Sharpe Telescoping Gages for Internal Measurements

The depth gage attachment, shown in Fig. 2, is designed for use on the blade of a combination square. It measures directly from the lower edge of the square blade. This tool is particularly adapted for measuring the depth of wide recesses, and has a range of from 0 to 4 1/2 inches with a 6-inch blade. The blade is graduated in thirty-sec-

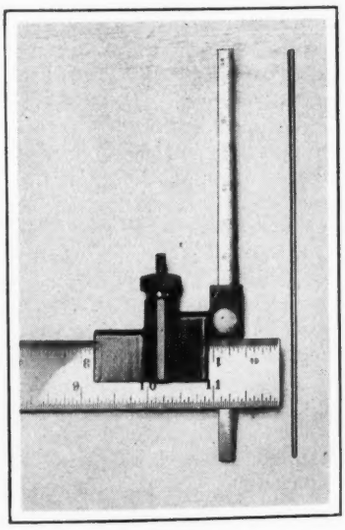
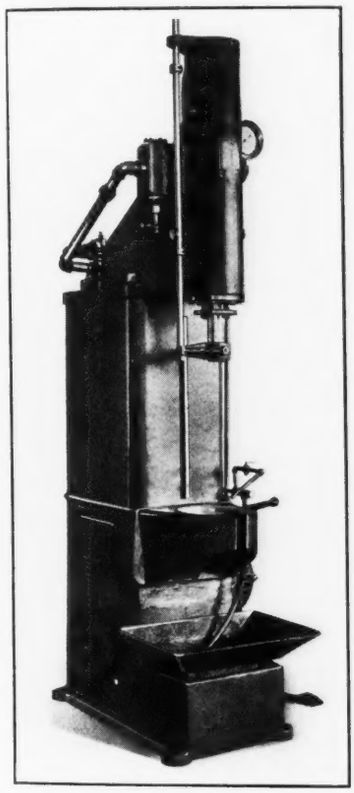


Fig. 2. Depth Gage Attachment for Blade of Brown & Sharpe Combination Square

onds and sixty-fourths of an inch or in sixty-fourths and one-hundredths of an inch, as desired. It can also be provided with metric graduations. A rod 5/64 inch in diameter is supplied for use in small holes that will not admit the blade.

AMERICAN TWELVE-TON HYDRAULIC PRESS

The 12-ton hydraulic press placed on the market recently by the American Broach & Machine Co., Ann Arbor, Mich., is intended for push-broaching, pressing work, and assembly and arbor work. It is controlled by a foot-pedal or a hand-lever, and is so arranged that the ram returns immediately to the top or starting position upon the release of either of the control levers. The ram speed of the standard machine is 15 feet per minute, but either a slower or a faster speed can be obtained by changing the speed of the driving pulley. The ram has a stroke of 26 inches, and the maximum clearance between the table and the end of the ram is 26 inches. Adjustable stops are provided, which can be set to give any predetermined length of stroke.



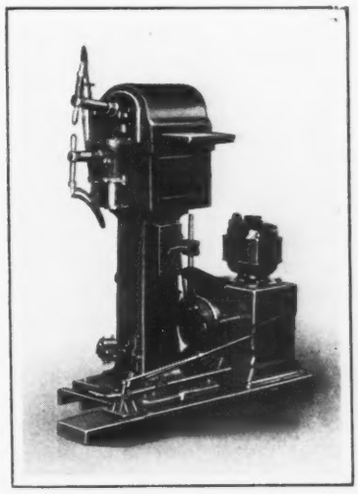
American Hydraulic Press for Heavy Broaching and Assembling Work

The bore in the table is 3 inches in diameter, and the throat has sufficient depth to accommodate work up to 15 inches in diameter. The finished top of the table is 12 inches in diameter. The power exerted by the press in pounds and tons can be determined from a direct-reading gage. A flexible control can be supplied which enables the operator to obtain any desired amount of pressure by varying the tension on the foot-pedal. This type of control is particularly well adapted for use in assembly work.

The machine is fitted with a solid cast-iron piston having two step-joint piston-rings and one leather cup. A floor space of 4 by 5 1/2 feet is required for operating this machine. The height of the work-table from the floor is 36 inches. It is recommended that the machine be operated by a 15-horsepower motor having a speed of 1800 revolutions per minute. The machine weighs 3900 pounds.

ACME MOTOR-DRIVEN SPOT-WELDERS

A line of motor-driven spot-welders has recently been developed by the Acme Electric Welder Co., 5621A Pacific Blvd., Los Angeles, Cal., with a view to decreasing the cost per weld, increasing the speed of production, reducing the fatigue of the operator, and producing uniform welds. These motor-driven units are of ball-bearing design and are driven by a 3/4-horsepower vertical motor. Five selective change-gears which are always in mesh give speeds of approximately 40, 60, 80, 100, and 120 welds per minute. Speeds are shifted instantaneously by operating a lever. An automatic engaging clutch and adjustable brake similar to those in use on punch presses provide for making positive spot-welds.

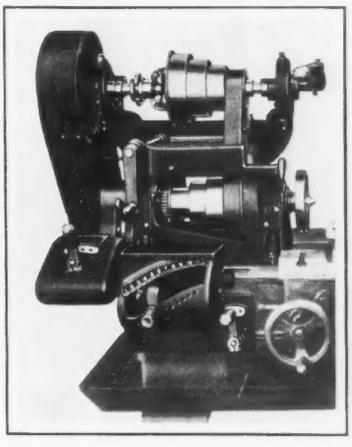


Acme Spot-welder with Motor-driven Unit

Each of these motor-driven spot-welders is actuated by a light pressure on a foot-treadle and continues in operation as long as the treadle is depressed. The machine stops immediately when the treadle is released. In this way, a single weld or a never-ending succession of welds can be made at the option of the operator. The line includes machines of various sizes with different lengths of throat and with different kilowatt capacities.

MOTOR DRIVES FOR C. & J. CONE-HEAD LATHES

Two types of motor drives have recently been brought out by the Carroll-Jamieson Machine



Type B Motor Drive Applied to Carroll-Jamieson Cone-head lathe

Tool Co., Batavia, Ohio, for application to the cone-head lathes built by this concern. The Type B drive, shown in the illustration, is provided with a mechanical shifter for the cone pulley belt. This device permits of shifting the belt quickly and safely by simply turning the lever one turn for each step of the pulley. The friction clutch built into the upper cone pulley is operated by a convenient control lever. The motor is mounted on an adjustable bracket at the back of the lathe bed. A guard for the main belt is supplied as part of the regular equipment, as shown in the illustration.

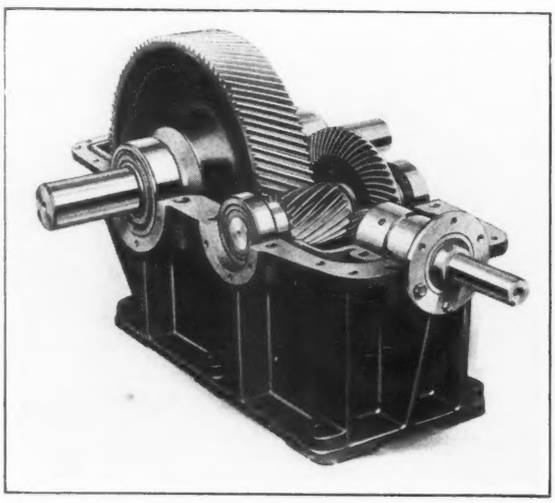
The Type A drive has all the features incorporated in the Type B arrangement, except the mechanical belt-shifter. With the Type A arrangement, a lever is provided for releasing the tension of the belt on the cone pulley, so that the operator can shift the belt by hand. Both types of drives are designed for 13-, 14-, 15-, and 16-inch C. & J. lathes. It is recommended that motors having a speed of 1200 revolutions per minute be employed. The size of motor required ranges from one horsepower for the 13-inch lathe, up to two horsepower for the 15- or the 16-inch lathe.

GARDNER-DENVER AIR COMPRESSORS

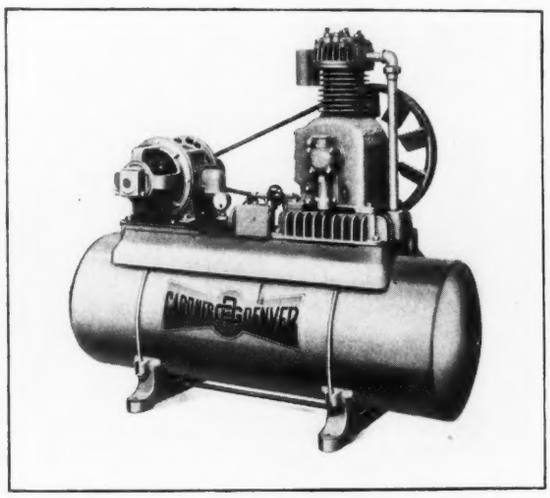
Enclosed suction and discharge valves located in separate chambers, in order to prevent the air from being heated when passing through the intake valves, are provided in the A-C-E model air compressor recently placed on the market by the Gardner-Denver Co., Quincy, Ill. This compressor is of the air-cooled single-stage type. The complete unit consists of a 3 1/2-by 4-inch duplex compressor and a 5-horsepower motor mounted on a cast-iron base at the top of the air receiver, as shown in the illustration. The unit has a displacement of 26 cubic feet per minute, operating at 600 revolutions per minute.

Continuous operation is assured by an automatic control, which is set to cut in at a pressure of 130 pounds per square inch, and cut out at 165 pounds per square inch. A positively driven plunger pump on the outside of the crankcase feeds filtered oil to troughs located under the connecting-rods. Other features of the compressor are a V-type belt drive, fan-type flywheel, aftercooler in the base, a muffler for the suction opening, and Hyatt roller bearings.

This company is also placing on the market a line of duplex two-stage synchronous motor-driven air compressors to complete the standard line of belt-



Falk Speed Reducer with Right-angle Drive



Gardner-Denver Single-stage Air Compressor

FALK RIGHT-ANGLE DRIVE SPEED REDUCERS

A line of right-angle drive speed reducers has been brought out by the Falk Corporation, Milwaukee, Wis., to supplement the line of reducers with parallel-shaft drives made by this concern. Both horizontal- and vertical-shaft reducers are included in the new line. An accurately cut single helical gear is used in combination with a spiral-bevel gear to obtain a quiet running drive. It is claimed that the efficiency of the reducers is over 95 per cent and that this high rate of efficiency can be maintained throughout the life of the unit.

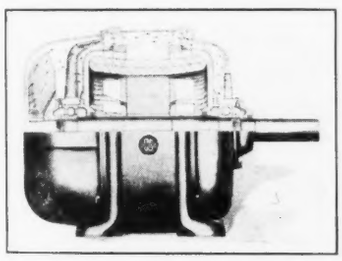
Reversible construction of the gears and shafts permits the shafts to be turned end for end, so that the opposite unworn sides of the teeth will be in driving contact after the sides that originally did the driving have become worn through years of service. The ratings of the reducers range from 1/16 horsepower at 100 revolutions per minute for the smallest unit up to 565 horsepower at 100 revolutions per minute for the largest unit. The smallest driving ratio in which the units are made is 1.5 to 1, and the largest ratio, 518 to 1.

The continuous splash system of lubrication keeps a film of oil on the working faces of the gear teeth. A complete line of welded-steel motor beds has been developed to accommodate the different sizes of motors that come within the capacities of the reducers.

and steam-driven equipment. In these compressors the motor is placed between the two main bearings where it is mounted directly on the crankshaft. The main shaft is mounted in roller bearings.

U. S. "DOUBLENCLOSED" MOTOR

Several improvements have been incorporated in the 1930 Model "Doublenclosed" motor made by the U. S. Electrical Mfg. Co., 200 E. Slauson Ave., Los Angeles, Cal. This motor is said to possess all the advantages of a fully enclosed motor. One of the features of the construction is that the wires are insulated by the incombustible fibers of asbestos in conjunction with a



U. S. "Doublenclosed" Motor

heat-resisting compound known as "Asbestosite."

The improved motor is encased within a sealed metal housing, outside of which there is a chamber which is subjected to an air blast through the action of a fan. Any dust, dirt, moisture, or deteriorating element is thus expelled from the outer chamber, making it impossible for foreign matter to enter the chamber where the moving parts are housed. The motor is intended primarily for use in installations where moisture, dripping water, abrasive particles, dangerous fumes, etc., may be present.

"RED JUNIOR BARRETT" LIFT TRUCK

A 2500-pound capacity light-duty lift truck, available in over 120 standard stock models, is being introduced to the trade by the Barrett-Cravens Co., 3269 W. 30th St., Chicago, Ill. Easy and quick operation are the particular

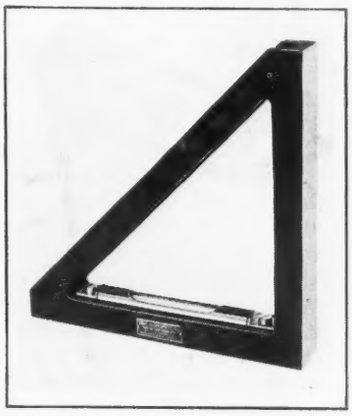
Barrett Lift Truck of 2500 Pounds Capacity

features claimed for this truck. Loads can be lifted with a single stroke of the handle and from any angle.

A spring device prevents the handle from falling to the floor where someone might trip over it. Also, this device takes the weight of the handle off the trucker's hands, so that he need exert his energy only in pulling the truck. A roller-bearing positive latch catch and an automatic engaging latch for lifting loads are other features. Hyatt roller bearings and the Alemite lubricating system are supplied as standard equipment.

"QUEEN" TRIANGULAR LEVEL

The "Queen" triangular level shown in the illustration is a recent product of the Gray Instrument Co., 64-70 W. Johnson St., Germantown, Philadelphia, Pa. This level measures 12 inches

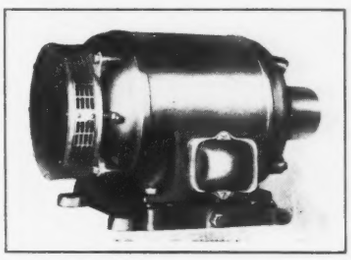


"Queen" Precision Triangular Level

on the right-angle sides and is intended especially for use in setting up machinery and machine equipment. The level vial is extremely sensitive and is accurately graduated to indicate the amount of displacement or variation from the level position. A protecting case is provided for the instrument.

CENTURY TOTALLY ENCLOSED FAN-COOLED MOTORS

One of the claims made for a line of totally enclosed fan-cooled squirrel-cage induction motors now being placed on the market by the Century Electric Co., 1806 Pine St., St. Louis, Mo., is that in most ratings, the motors have the size advantages of stan-

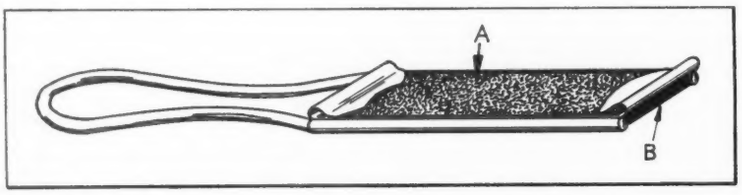


Century Totally Enclosed Fan-cooled Motor

dard open-rated motors. An additional advantage consists of full protection to the stator, rotor, and other internal parts of the motor, all of which are isolated from the outside air. The motor is completely enclosed by ribbed cast-iron coil guards having all fits machined. This construction prevents dust and dirt from entering the windings or rotor, even though present in abnormal quantities.

As seen in the illustration, the fan and its housing are mounted externally on the front end of the motor, opposite the pulley end. The cooling air is drawn in at the pulley end, circulated around and over the rear coil guard, through the air passages between the field core and the frame, out over the coil guard on the front end, and discharged into the air through the fan and fan housing.

The air passages are not easily clogged and may be readily blown

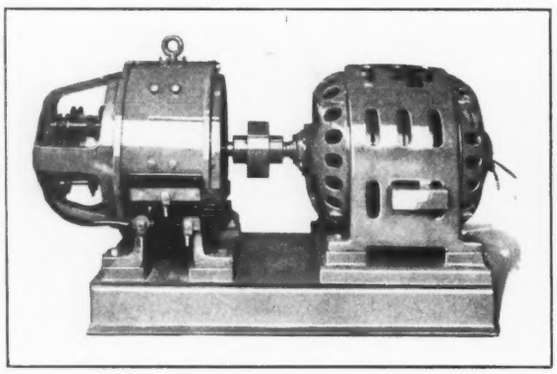


Pencil Pointer with Renewable Emery Cloth and Felt

out with compressed air if that should become necessary. The fan blades are radial to make the cooling system effective regardless of the direction of rotation of the blades.

RELIANCE MOTOR-GENERATOR SETS WITH WELDED BASES

The Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio, is now using electrically welded bases constructed from heavy steel plate for the motor-generator sets which this company manufactures in sizes up to 250 kilowatts. As shown in the illustration, the tops and ends of the welded bases are completely closed, so that no dirt can collect underneath. The pads on which the motor and the generator rest are lined up horizontally and vertically by using the machines themselves to gage the alignment. Such shims as are needed are placed between the pads and the base. The pads with the shims beneath them are then welded to the base. Horizontal alignment is maintained by the use of tight-fitting dowels driven into the pads through two diagonally opposite feet.



Reliance Welded Base for Motor-generator Sets

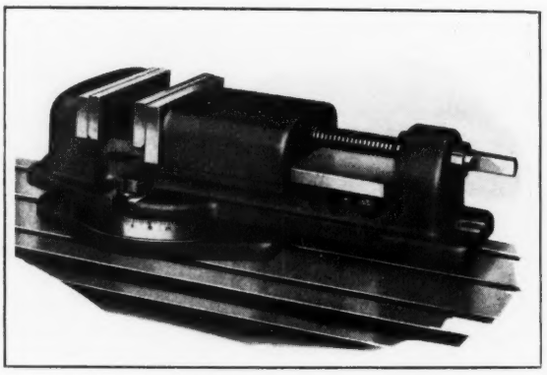
"NOK-OUT" PENCIL POINTER

Light weight, convenience in handling, and long life are features claimed for the pencil pointer shown in the illustration. This pointer is being placed on the market by H. W. Cable, 5716 Euclid Ave., Cleveland, Ohio. It is designed for draftsmen, and is made of sheet metal with a renewable sheet of emery cloth *A* and a renewable felt wiper *B*. The tool is made to stand rough usage without loosening the felt or emery cloth. The felt provides a convenient means of wiping the dust from the lead so that it will not accumulate on the drawing.

CINCINNATI PLAIN AND SWIVEL VISES

Plain and swivel vises of a new design have recently been placed on the market by the Cincinnati Milling Machine Co., Cincinnati, Ohio, in the Nos. 3 and 5 sizes. In redesigning these vises, the metal has been distributed with a view to increasing the strength at the critical points and adding to the rigidity of the entire structure. Considerably more metal has been added to the fixed jaw section and to the abutment which forms the support for the screw that actuates the movable jaw. The jaws are made of hardened and ground steel.

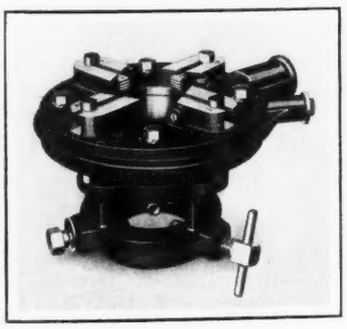
The illustration shows a swivel vise. The bottom of the plain vise is finished so as to enable it to be converted into a swivel vise by merely assembling it to a swivel base. The latter is graduated in degrees. The No. 3 plain and swivel vises have jaws 6 1/8 inches wide by 1 5/8 inches deep, with a maximum opening of 4 inches; while the No. 5 vises of both styles have jaws 8 5/8 inches wide by 2 1/2 inches deep, with a maximum opening of 7 inches. The swivel vises form part of the regular equipment of the universal milling machines built by the company, and the plain vises, of the plain and vertical milling machines.



Cincinnati Swivel Vise of Improved Design

BEAVER "FOUR-POSTER" DIE-STOCK

Beaver four-post die-stocks have recently been placed on the market by the Borden Co., Warren, Ohio. They are made in the plain No. 8 and the ratchet No. 8R types for threading 1-,



Beaver "Four-Poster" Die-stock with Self-contained Rear End

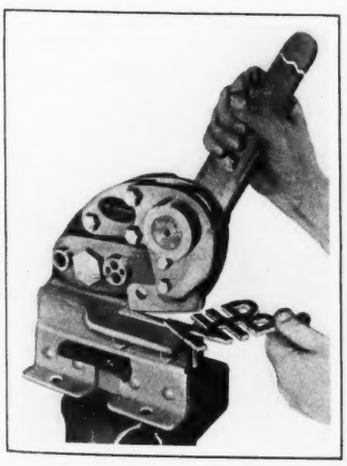
1 1/4-, 1 1 2-, and 2-inch pipe. These die-stocks use a separate set of dies for each size of pipe, and instead of loose bushings, they have a self-contained patented rear end.

Adjustments for the different sizes of pipe are made by dropping a hardened steel washer into the proper groove in each of the heavy guide bolts. Clamping is accomplished by tightening the cross-pin screw, which is made of sufficient size to permit obtaining a good hand-hold. A convenient feature of these tools is the open die slot, which can be readily cleaned. The weight of the ratchet type tool shown in the illustration is 12 3/4 pounds.

"HANDNIB" NIBBLER, SHEAR AND ROD CUTTER

Flat stock up to 3/16 inch thick can be nibbled or sheared with a Model No. 4 heavy-duty "Handnib" recently designed by the National Machine Tool Co., 1536 Clark St., Racine, Wis. Rods from 3/16 to 1/2 inch in diameter can be cut. This model differs from the one described in June, 1929, MACHINERY, page 796, both in capacity and in having a double-crank construction. The latter features makes for easy hand operation.

Both outside and inside nibbling of sheets can be done. The maximum depth of cut in inside nibbling is 4 inches from any outside edge. The equipment

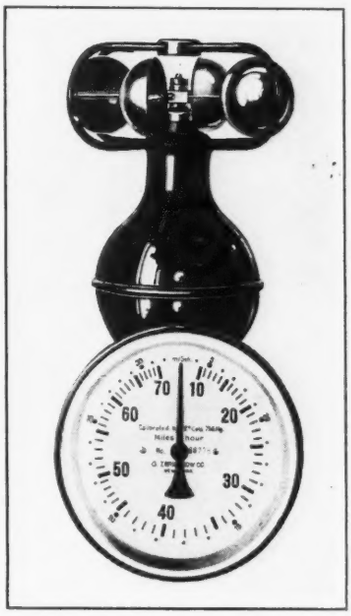


"Handnib" which Nibbles or Shears up to 3/16 Inch Flat Stock

may be held in a vise, as illustrated, or fastened to a bench.

"O-Z ANEMO" TACHOMETER

The air capacities of fans, pumps, compressors, blowers, etc. can be determined by means of an air velocity meter known as the "O-Z Anemo" tachometer, which is being placed on the American market by the O. Zernickow Co., 21 Park Row, New York City. The instrument

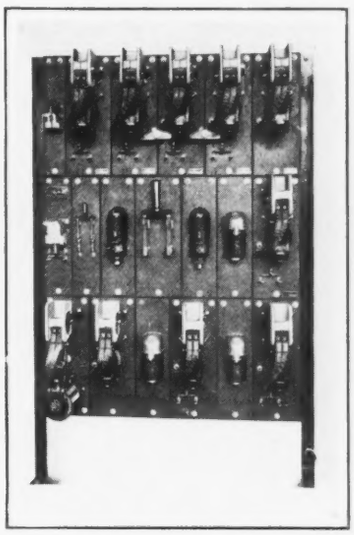


"O-Z Anemo" Tachometer for Determining Air Capacities

is a combination of the Robinson cup cross and a centrifugal tachometer.

BRAKING CONTROLLER FOR CRANE HOISTS

A Wright dynamic lowering circuit controller recently placed on the market by the Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio, is of the magnetic contactor type. It is designed to release the solenoid-operated brake instantly when the master control lever is moved for lowering. This feature permits the master control lever to be moved instantly to the position that will give the desired speed without having to let the control pause on the first



Wright Dynamic Lowering Circuit Controller for Crane Hoists

position in order to give the brake-releasing solenoid time to operate.

The quick action of this control is obtained by having all the line current actuate the brake-releasing solenoid on the first contact position of the master control lever. This insures faster crane operation.

IRONITE—A NEW ALLOY IRON

A new alloy iron known as "Ironite" has been developed by the Kinite Corporation, Milwaukee, Wis. This firm is known as the manufacturer of Kinite. Ironite is a similar alloy, but is available at a lower price; it provides the same advantages as Kinite to a somewhat less degree. Because of its close, uniform grain and toughness, it has unusual abrasive and compressive resistance, but does not wear as long as Kinite. It is cast to shape like Kinite, thus saving machining and permitting dies to be cast in one piece, which, if made from forgings, would have to be made in sections. It is an electric furnace iron in which, among other metals, chromium, vanadium, and nickel play an important part. Ironite is recommended for forming dies and for machine parts where a close-grained alloy iron is required.

AN UP-TO-DATE APPRENTICE SYSTEM

An apprentice system organized according to modern ideas is maintained by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. The apprentice training comprises four years in machine shop practice. A course is also provided for four years' training in foundry practice. In addition to the practical machine shop work, the apprentices receive instruction in mechanical drawing and other classroom work. The instruction in these subjects is given in the Roosevelt High School of Birdsboro, but the instructors are supplied by the Birdsboro Steel Foundry & Machine Co., so that the entire training of the young men is in the hands of the company. Certain periods are also set aside each week for a general discussion of various engineering problems. These discussions have proved very popular with the young men and have created a great deal of interest. The recreational side is also given due consideration, and the apprentices are encouraged to take part in sports.

A Group of Apprentices being Trained at the Plant of the Birdsboro Steel Foundry & Machine Co.

* * *

NEW PROCESS FOR PRODUCING WROUGHT IRON

Wrought iron was produced in Egypt probably 5000 years ago. The metal continued to be made by the primitive means used by the Egyptians until the invention of puddling in 1784. This slow and expensive hand process has been used ever since, but it may soon give way to a new method developed by Dr. James Aston of the Carnegie Institute of Technology. The new process has been adopted by the A. M. Byers Co. of Pittsburgh, Pa.

According to a report of the United States Bureau of Standards entitled "Comparative Properties of Wrought Iron Made by Hand Puddling and by the Aston Process," the new method differs radically from the conventional hand puddling process in that the pig iron, after being melted in a cupola, is refined in a Bessemer converter, and then mixed with slag which is prepared in a separate furnace. The operation by which the slag is mixed intimately with the iron consists in pouring the molten metal into a bath of the molten slag. The "ball" thus formed, after being squeezed into a bloom, is rolled in the ordinary manner to the required shape.

The chemical composition of the iron made by the new process agrees closely with that of hand-puddled iron. The carbon content is lower in the new process iron and more uniform, metallographic examination showing that "carbon streaks" are absent in the structure. The sulphur content of the new process iron, according to tests made, is not quite so low as that of the hand-puddled product. No marked difference is found in the density of the two irons; the new process iron has a slightly higher density, but the difference is so small, as to be negligible.

No marked difference in the mechanical properties was found in tests made of the two irons in pipe form. The iron made by the new process, on the whole, shows a slightly lower tensile strength but a higher ductility. It is stated that pipe made from the new process iron meets the requirements of current specifications for pipe of the American Society for Testing Materials and of the Federal Specifications Board.

Accelerated laboratory corrosion tests indicate a very slight difference in the corrosion resistance in favor of the hand-puddled iron. The hand-puddled process is not nearly so favorable for the complete elimination of carbon as is the new process.

In the observations made at the mill where the iron was produced, nothing indicated that the behavior of the new process wrought iron in welding, galvanizing, or machining would be inferior to hand-puddled wrought iron.

John B. Henrechon, who has been for Fifty Years with the Pratt & Whitney Co.

* * *

FIFTY YEARS WITH ONE COMPANY

John B. Henrechon has just completed fifty years in the employ of the Pratt & Whitney Co., Hartford, Conn. On his fiftieth employment anniversary, he stopped work long enough to receive the congratulations and good wishes of his employers and fellow workmen. C. R. Burt, vice-president and general manager of the Pratt & Whitney Co., presented Mr. Henrechon with a basket of flowers as a symbol of the appreciation of the company for his long and faithful service. The presentation speech was made by Gene Laporte, who has a record of fifty-three years of continuous service with the Pratt & Whitney Co.

PERSONALS

MAJOR ELAM has been appointed branch manager of the Minneapolis territory of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo.

WALTER W. TANGEMAN, who has been for several years general sales manager of the Cincinnati Milling Machine Co., Cincinnati, Ohio, has been made vice-president of the company.

L. C. BULLINGTON, formerly manager of the Detroit office of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., recently was appointed general sales supervisor of the company.

B. S. MITCHELL has been appointed advertising manager for the Samson-United Corporation, Rochester, N. Y.,

E. C. Waldvogel

manufacturer of stainless steel kitchen tools and electrical appliances.

FREDERICK ALAN SCHAFF has been elected president of the Superheater Co., 17 E. 42nd St., New York City, succeeding GEORGE L. BOURNE, who has been elected chairman of the Board of Directors.

C. N. BRUBAKER has been appointed managing engineer of the transformer department of the Erie, Pa., Works of the General Electric Co. Mr. Brubaker is head of all engineering and manufacturing activities of the department.

WILLIAM B. LAWSON, who has been connected for twenty-five years with the International Nickel Co. of New York, was elected a director and vice-president of the Harshaw Chemical Co., Cleveland, Ohio, at the last annual meeting.

L. J. DICIANNE has been transferred from the position of branch manager of the Minneapolis office of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., to the position of branch manager of the Kansas City office.

EDWARD H. HUBERT, formerly assistant secretary of the American Institute of Electrical Engineers, has been appointed director of publicity for the National Electrical Manufacturers' Association, 420 Lexington Ave., New York City, succeeding ALBERT PFALTZ.

M. W. SEYMOUR has become associated with the New York office of the Roller-Smith Co., maker of electrical instruments and circuit-breakers, as sales engineer. Mr. Seymour has been located for several months at the company's Bethlehem, Pa., works.

PAUL H. BROWN has been appointed manager of the St. Louis district of Robbins & Myers Sales, Inc., to take the place of C. R. McKinnon, who recently lost his life in an airplane crash at Kansas City. Mr. Brown was previously divisional manager at Kansas City for the National Union Radio Corporation.

E. C. WALDVOGEL, vice-president in charge of sales of the Yale & Towne Mfg. Co., Stamford, Conn., manufacturer of locks, builders' hardware, and materials handling equipment, will retire from active participation in the company's affairs April 1. Mr. Waldvogel has been connected with the Yale & Towne Mfg. Co. for twenty-five years. He will continue to serve in an advisory capacity, and will hold the office of vice-president as well as director. WALTER B. DODGE, who has been assistant to Mr. Waldvogel, has been appointed manager of all Stamford hardware sales. JAMES C. MORGAN will have complete charge of all materials handling equipment sales.

James C. Morgan

ARTHUR C. PLETZ, assistant general sales manager of the Pratt & Whitney Co., Hartford, Conn., has resigned to become works manager of the Aluminum Industries, Inc., Cincinnati, Ohio. WILLIAM LAW, sales engineer for the Pratt & Whitney Co., Hartford, Conn., has been made manager of the Agency Sales Division.

FREDERICK B. HEITKAMP has been appointed general sales manager of the Cincinnati Milling Machine Co., Cincinnati, Ohio, succeeding WALTER W. TANGEMAN, who has been made vice-president. Mr. Heitkamp was formerly assistant sales manager. His new duties will include complete supervision of sales activities.

W. EARLE PASHLEY, advertising manager of the C. F. Pease Co., 822 N. Franklin St., Chicago, Ill., has been appointed assistant sales manager and second vice-president. Mr. Pashley was also elected a member of the board of directors. He will continue to have charge of advertising.

E. E. LE VAN was appointed general sales manager of the Haynes Stellite Co., 30 E. 42nd St., New York City, at a recent directors' meeting. J. H. MAGUIRE was appointed works manager; F. T. MCCURDY, plant superintendent; J. R. BROWN, F. L. SECORD and EVERETT PAGE, assistants to superintendent; and L. H. BROWN, research engineer.

J. G. BENEDICT, general manager of the Landis Machine Co., Waynesboro, Pa., and C. N. KIRKPATRICK, general sales manager of the same company, sailed for Europe January 31. They expect to

Walter B. Dodge

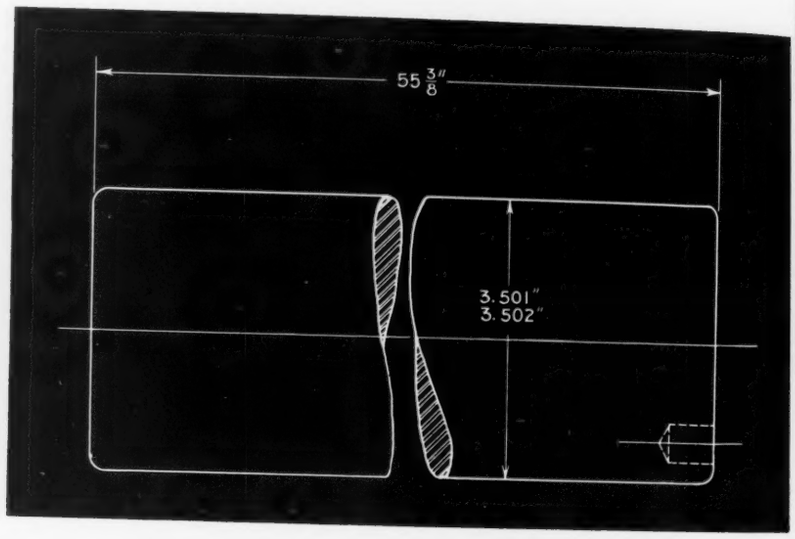
spend approximately two months in England and on the Continent securing first-hand information about European industrial conditions.

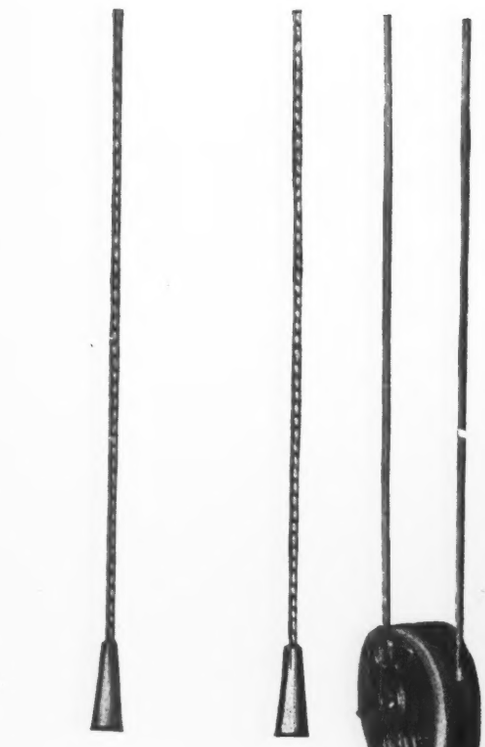
FERD. T. NEBEL has been elected president and treasurer of the Rahn-Larmon Co., Cincinnati, Ohio, manufacturer of lathes of various types. Mr. Nebel has been connected with the machine tool industry for the last thirty years both as a designer and as superintendent. For the last nine years he has served as treasurer of the Rahn-Larmon Co.

S. B. TAYLOR has recently been promoted to the position of assistant works manager of the Reliance Electric & Engineering Co., 1042 Ivanhoe Road, Cleveland, Ohio. Mr. Taylor began work with this company in 1925 as design engineer of alternating-current motors. In 1928 he was advanced to the position of engineer in charge of drafting, and has held this position up to the present time.

BENJAMIN O'SHEA, formerly president of the Union Carbide Co. and of the Electro Metallurgical Co., both units of the Union Carbide & Carbon Corporation, 205 E. 42nd St., New York City, was elected chairman of the board at a recent directors' meeting. FRED H. HAGGERSON, former vice-president of the two companies, succeeds Mr. O'Shea as president. F. P. GORMELY was elected vice-president and general manager.

5½ Minutes –





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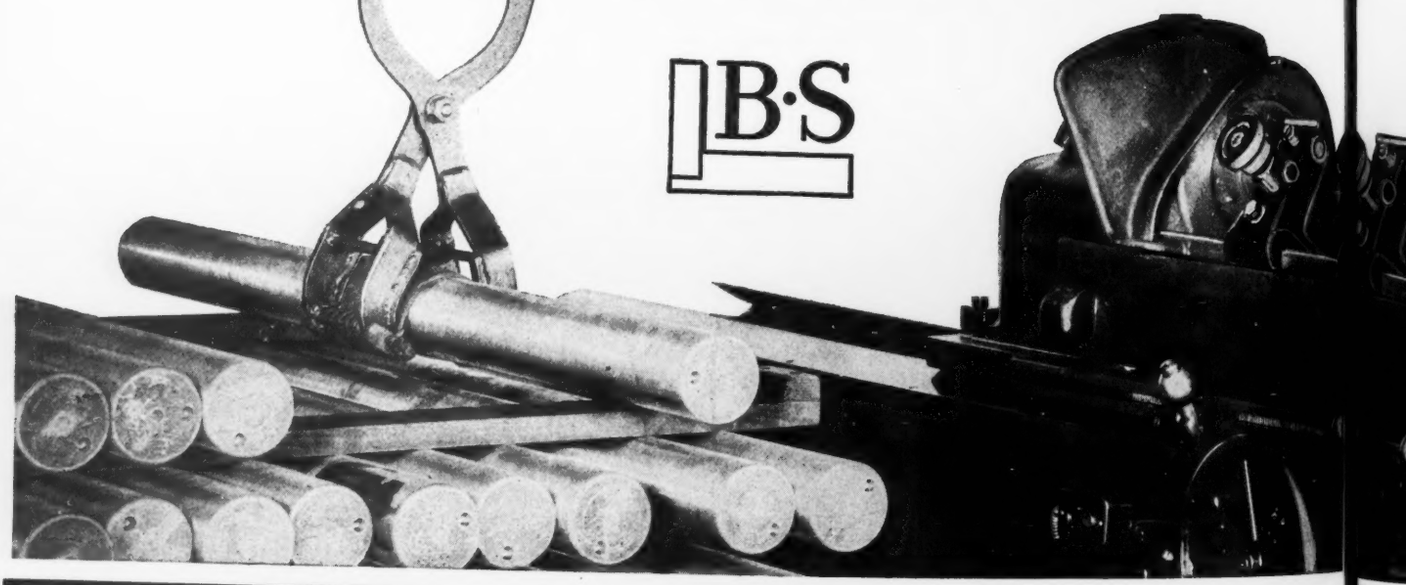


BROWN & SHARPE

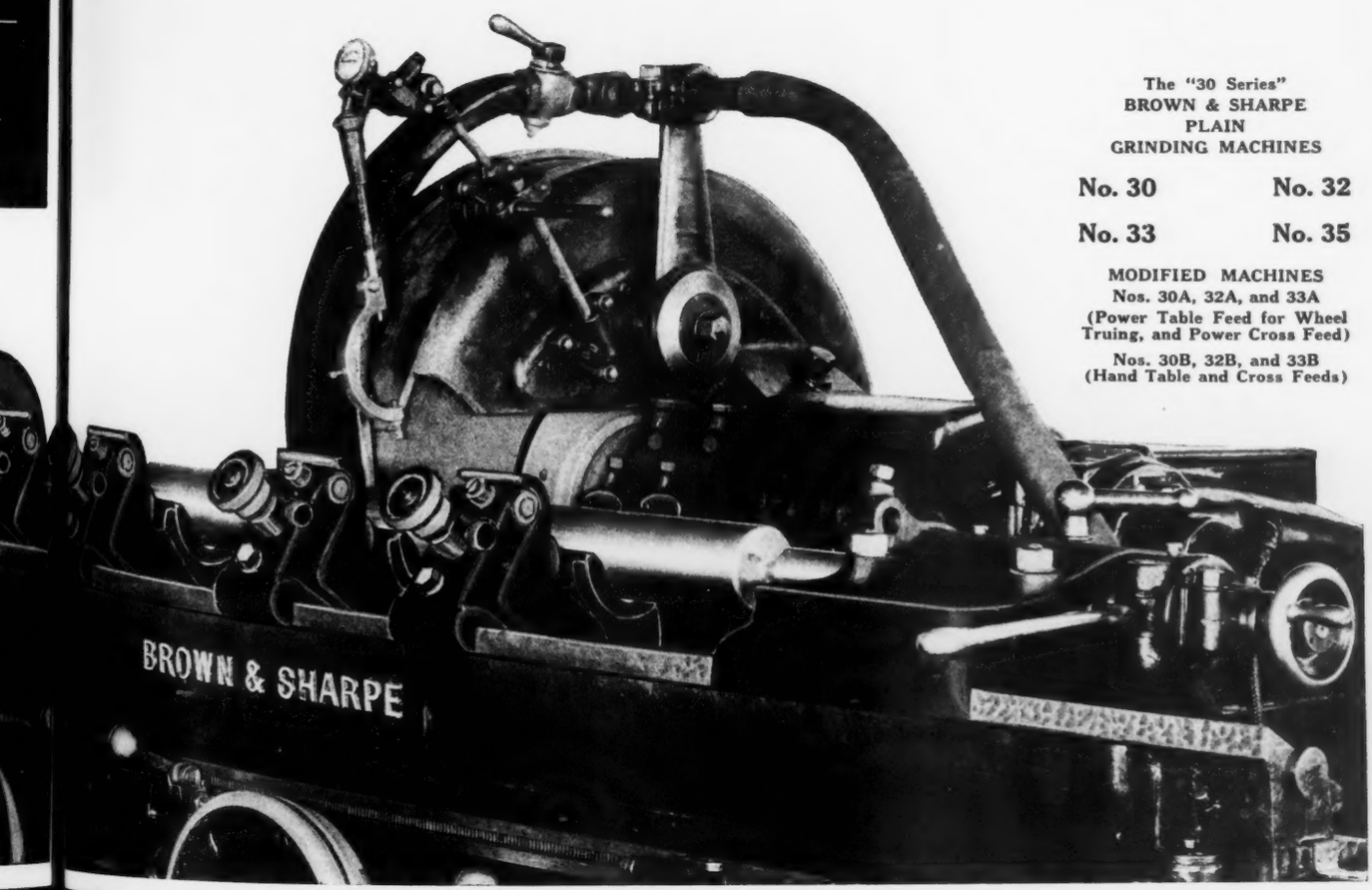
-Floor to Floor

for this piece on a Brown & Sharpe No. 35 Plain Grinding Machine

The job is that of rough grinding a milling machine overarm. .012" to .015" of stock is removed from the diameter and the tolerance is .001". Full advantage is taken of the high table speeds available, the table being run at two hundred and fifty-three inches per minute.

Long, heavy work up to seventy-two inches in length, can be rapidly and economically ground on the No. 35 Plain Grinding Machine.

The "30 Series" Brown & Sharpe Plain Grinding Machines are making some remarkable production records because of their great power and the broad range of speeds and feeds which not long ago would have been considered phenomenal for commercial work. Complete specifications will be mailed at your request. Brown & Sharpe Mfg. Co., Providence, R. I.



The "30 Series"
BROWN & SHARPE
PLAIN
GRINDING MACHINES

No. 30 **No. 32**

No. 33 **No. 35**

MODIFIED MACHINES
Nos. 30A, 32A, and 33A
(Power Table Feed for Wheel Truing, and Power Cross Feed)
Nos. 30B, 32B, and 33B
(Hand Table and Cross Feeds)

PLAIN GRINDING MACHINES

Nos. 30, 32, 33 and 35

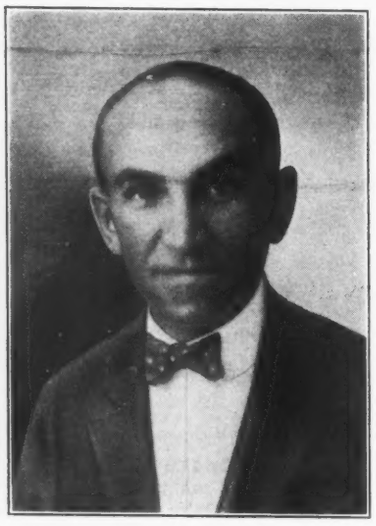
R. E. HELLMUND, chief electrical engineer of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been awarded the Lamme Medal of the American Institute of Electrical Engineers "for his contributions to the design and development of rotating electrical machinery." It is expected that the medal will be presented at the summer convention of the Institute, which is to be held in Toronto, Canada, June 23 to 27.

JOHN R. PATTERSON has been appointed district manager of the Chicago offices of the Union Electric Mfg. Co., at 210 Lomax Bldg., 1608 W. Madison St., Chicago, Ill. Mr. Patterson has been in charge of the electrical division of Fairbanks, Morse & Co., Cleveland, Ohio, for the last four years, and prior to that was connected with the Allis Chalmers Co. R. F. LUKE will be associated with Mr. Patterson at the Chicago office. C. L. RUSSELL, who has been on the sales force of the company for over ten years, has been transferred from the Chicago office to the Milwaukee factory, where he will become the instructor and trainer of student engineers. He will also have charge of the local sales territory. GARRITT S. FELT has been appointed district manager with headquarters at Room 404 Merchants National Bank Bldg., Omaha, Neb.

OBITUARIES

FRANK G. HOFFMAN

Frank G. Hoffman, sales manager of the machine and small tool divisions of the Barber-Colman Co., Rockford, Ill., died suddenly February 10 at his home in Rockford. He had left the plant that afternoon after 5 o'clock, apparently in



Frank G. Hoffman

good health, and was preparing to leave that night for a business trip to St. Louis when, without warning, he was stricken with a heart attack. The suddenness of his passing away came as a great shock to his many friends in the mechanical industries.

Mr. Hoffman was born in Chicago in 1882 and received his education in the Chicago schools. Before connecting with the Barber-Colman Co., he was employed by the Northwestern Elevated Railway Co. and the Milwaukee Electric Co. In 1912 he came to Rockford, Ill., as salesman for the Barber-Colman Co. The next year he was made sales manager of the machine and small tool divisions of the company, continuing in that position until his death.

His energy, ability, and the fine example that he set had much to do with the successful growth of that part of the business under his direction. The many friends he had made in the industry were in evidence when he visited the meetings of trade associations like the National Machine Tool Builders' Association and the American Gear Manufacturers' Association. One of his associates in the business with which he was connected for so many years says of him: "He was a true gentleman in the finest sense. His unfailing courtesy and kindliness and his sense of fair play made him a rare friend."

FRANCIS COLE PRATT, former vice-president and chairman of the manufacturing committee of the General Electric Co., Schenectady, N. Y., died January 26 in New York City after an illness of six weeks. Mr. Pratt was born in Hartford, Conn., in 1867, and graduated from the Sheffield Scientific School of Yale University in 1888. After graduation, he was associated with the Pratt & Whitney Co., of which his father was president and one of the founders, and continued with that company until he became vice-president. Mr. Pratt joined the General Electric Co. in 1906 as assistant to E. W. Rice, in charge of manufacturing and engineering. He was made assistant to the president in 1913, and was elected vice-president in 1919. He retired in 1927. Mr. Pratt was a member of the Munitions Standards Board of the United States Council of National Defence in 1917.

FRED M. KIMBALL, advisory manager of the Motor Division of the Industrial Department of the General Electric Co., Schenectady, N. Y., died February 5 in Lynn, Mass. Mr. Kimball was connected with the General Electric Co. for many years, and was well known throughout the motor industry. He had been ill for some time. He was born in Barton, Vt., July 7, 1861, and was educated in Massachusetts, taking a course in electrical engineering at the Massachusetts Institute of Technology. In 1886, he established a business partnership specializing in the manufacture and sale of isolated lighting plants, motors, and electrical specialties. In 1891 he entered the employ of the General Electric Co., New England district, and in 1898 was made manager of the small motor department at its formation.

HARRY AINSWORTH

Harry Ainsworth, president of Williams, White & Co., Moline, Ill., manufacturers of surface grinders, presses, punches, shears, forging machinery, castings, and forgings, died in the University Hospital at Iowa City, Iowa, February 6, after a short illness. Mr. Ainsworth was sixty-seven years old. He had been associated with Williams, White & Co. over forty years, for the last sixteen years as president.

Mr. Ainsworth was born in Geneseo, Ill., in 1862. When he was eight years old, his family moved to Moline, Ill., where he attended school, later entering Oberlin College, from which he graduated in 1884. He then entered the Law School at Harvard University, graduating in 1887. He was admitted to the bar in Illinois soon after graduation, but did not practice; instead he entered in the employ of the Williams, White

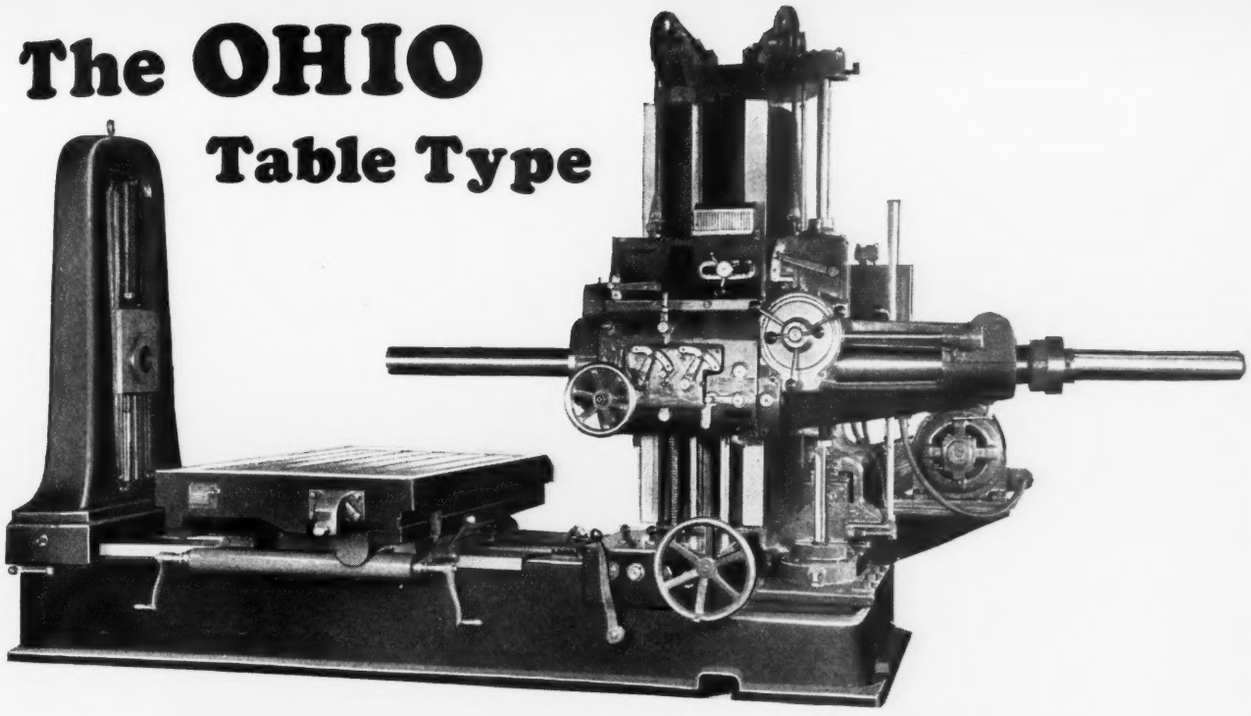
Harry Ainsworth

& Co., of which his father was president. He became vice-president and general manager during the last years of his father's life, and since his father's death in 1914, has been president and general manager of the company. During the World War he organized the Moline Forge, Inc., and built a plant for the production of forgings.

CLARENCE W. HODGES, general purchasing agent of the Worthington Pump & Machinery Corporation, 2 Park Ave., New York City, died suddenly on January 17 at the Paterson (N. J.) Hospital, following an operation. Mr. Hodges was born at Randolph, Vt., May 15, 1876, and was graduated from Williams College in 1900. For some years he was employed by the American Locomotive Co. as purchasing agent and since 1918 had been employed in the same capacity by the Worthington Pump & Machinery Corporation.

GEORGE N. CLEMSON, president of the Victor Saw Works, Inc., died at his home in Middletown, N. Y., January 30, at the age of seventy-four. Mr. Clemson was prominent in the metal saw industry and was the originator of the Star hacksaw.

The OHIO Table Type



Horizontal Boring, Drilling and Milling Machines

The Ohio Table Type Horizontal Boring, Drilling and Milling Machine is built to drive high speed cutting steels to capacity limits. In many ways, the Ohio Horizontal differs considerably from machines of conventional design. These differences are worthy of careful consideration, for they are in a great measure responsible for the ability to produce extremely accurate work and also when required, "hog-off" metal to the full capacity of the unusually powerful drive. The table type machine is built with 4″ and 5″ spindle diameters, with other dimensions, specifications, and attachments arranged to suit requirements of the work.

Ohio Horizontal Boring, Drilling and Milling Machines are also built in all other standard types and sizes, meeting every requirement for high grade machine tools of this class.

PLANER TABLE TYPE MACHINE

Built with 4″ and 5″ spindle diameters with tables, beds and dimensions arranged to suit the job.

FLOOR TYPE MACHINES

Built with 4″ and 5″ spindle diameters, with vertical traverse of spindle up to 7′ 0″ and horizontal traverse of post on runway to suit the job. Bed plates, bar supports, and other accessories to suit requirements. Universal tilting and revolving tables, plain rotary, power operated rotary and stationary work tables.

COMBINATION FLOOR AND TABLE TYPE MACHINES

Built with 4″ and 5″ spindle diameters consisting of standard floor type machine, equipped with table type bed, saddle, bar support either hand or power operated, giving practically all the advantages of the table type machine and with the table unit removed, the great range of the floor type machine is made available.

OHIO MACHINE TOOL COMPANY, KENTON, OHIO

Sole Distributors

JOSEPH T. RYERSON & SON INC.

CHICAGO MILWAUKEE MINNEAPOLIS DULUTH DENVER LOS ANGELES SAN FRANCISCO ROCKFORD
HOUSTON KANSAS CITY TULSA ST. LOUIS CINCINNATI CLEVELAND DETROIT BUFFALO
PITTSBURGH PHILADELPHIA RICHMOND BOSTON JERSEY CITY NEW YORK DALLAS GRAND RAPIDS

NEWS OF THE INDUSTRY

TRUNDLE ENGINEERING Co., Cleveland, Ohio, has taken over 3200 square feet of additional floor space to permit of necessary expansions.

READING CHAIN & BLOCK CORPORATION, Reading, Pa., has appointed W. J. Zink representative of the corporation for Alabama and vicinity.

ECCLES & DAVIES MACHINERY CO., INC., 316 S. San Pedro St., Los Angeles, Cal., has been appointed sole California distributor for the sale of Krupp Widia metal.

CUTLER-HAMMER, INC., 166 Twelfth St., Milwaukee, Wis., announces that the Detroit district sales office of the company is now located at 2755 E. Grand Boulevard.

UNITED ENGINEERING & TOOL CO., 3160 Kensington Ave., Philadelphia, Pa., has been organized to engage in the design of intricate machinery and special tools, dies, gages, jigs, and fixtures.

AXELSON MACHINE CO., LOS ANGELES, Cal., manufacturer of oil field equipment, has changed its name to AXELSON MFG. CO., LTD. The management will continue as in the past.

HEPPENSTALL FORGE & KNIFE CO., Pittsburgh, Pa., has changed its name to HEPPENSTALL CO. This was done because the business now covers a wider scope than would be understood from the former name.

BUFFALO STEAM PUMP CO., Buffalo, N. Y., elected the following officers at its annual meeting: President and treasurer, Edgar F. Wendt; vice-president, Henry W. Wendt, Jr.; and secretary, Amos G. Peterson.

PRODUCTION ENGINEERING CO., W. 1848 Broadway, Spokane, Wash., has secured the manufacturing rights for the "Multimechanic," a machine tool recently developed by the Simplex Mfg. Co. and described in December, 1929, MACHINERY, page 328.

CARBOLOY CO., INC., 350 Madison Ave., New York City, has opened a branch sales office in the Chimes Building, Syracuse, N. Y., which will serve the northern, central, and western parts of New York state. C. W. Davis is in charge of the new office.

CHESAPEAKE CRANE CORPORATION, Baltimore, Md., has appointed H. H. Knowles, 625 Third St., San Francisco, Calif., representative of the company in the states of New Mexico, Colorado, Wyoming, Montana, Idaho, Utah, Arizona, Nevada, California, Oregon and Washington.

W. H. BIXBY, INC., has moved its main office from Omaha, Neb. to 1004 Hubbell Building, Des Moines, Ia. This company is representative for the Taylor under-feed stokers and Lo-Hed monorail electric hoists manufactured by the American Engineering Co., of Philadelphia, Pa.

LINK-BELT LTD., recently opened a branch office in the Standard Bank Building, 510 W. Hastings St., Vancouver, Canada, with Frank B. Wetherill in charge. Mr. Wetherill has been manager of the company's office and warehouse in Portland, Ore., for a number of years.

O. K. TOOL CO., INC., Shelton, Conn., has awarded to the Austin Co., Cleveland Ohio, a contract for the design and building of two structures for manufacturing, heat-treating, and storage purposes. The larger of the two buildings, part of which will be four stories high, is 40 by 182 feet.

OSTER-WILLIAMS CO., Cleveland, Ohio, a recent merger of the Oster Mfg. Co. and the Williams Tool Corporation, held its first sales convention recently in Cleveland, which was attended by thirty-eight men representing the combined sales forces of the two original companies. The meeting covered a period of five days.

MORSE-GRAU TOOL & MFG. CO. has been established at 1520 E. Slauson Ave., Los Angeles, Cal., to specialize in designing and manufacturing to order such tools as milling cutters, form cutters, reamers, boring-bars, jigs, fixtures, and gages. William S. Morse is president of the company, and William S. Grau, general manager.

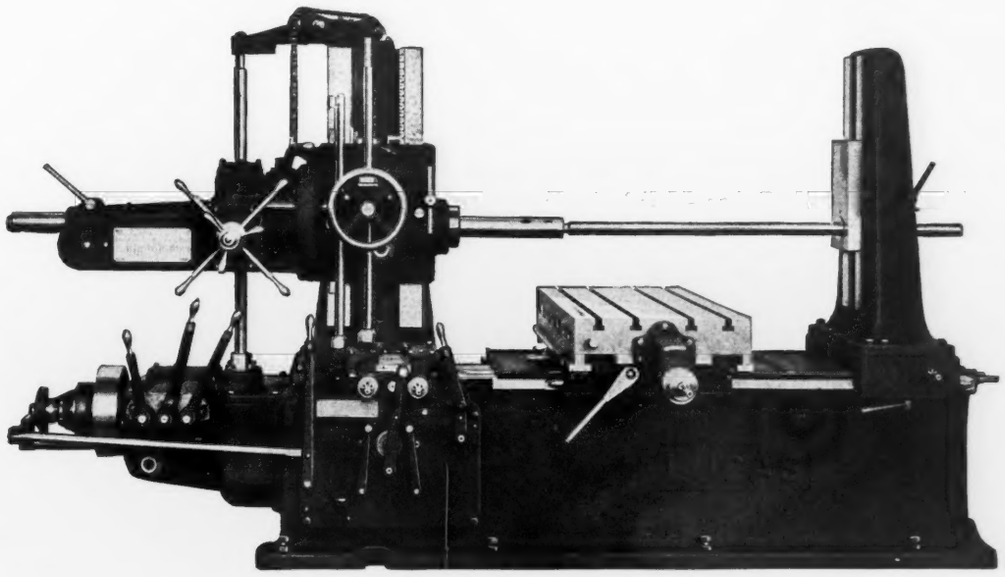
OLIVER MACHINERY CO., Grand Rapids, Mich., recently held a sales convention at Grand Rapids, attended by the company's twenty-six salesmen from all over the country. During the convention the salesmen had an opportunity to study the new manufacturing methods that have recently been installed in the three plants of the company, and familiarize themselves with the new developments in the Oliver line of woodworking machinery and tool grinders.

Officers and Salesmen of the Oliver Machinery Co., Attending the Company's Sales Convention

BILLINGS & SPENCER CO., Hartford, Conn., manufacturer of drop-forged tools, drop-forging machinery, contract forgings, etc., announces the opening of a New York office and warehouse at 53 Warren St., with W. Roy Moore in charge as metropolitan sales manager. A complete stock of Billings & Spencer products will be carried at the New York office.

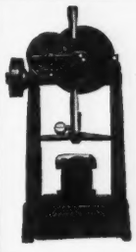
RAHN-LARMON CO., Cincinnati, Ohio, manufacturer of lathes of various types, announces that at a meeting of the stockholders of the company the follow-

"A ship is a ship only when she's sailing"—
And so a boring machine is a boring machine only when she's boring; and the same with a drilling or a milling machine.



When the "PRECISION" Boring, Drilling and MILLING MACHINE

is not doing one thing she is doing another, and often does all three at one setting of the work, therefore *Never Stands Idle.*



WE ALSO MAKE THE
LUCAS POWER
Forcing Press

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

ing directors were elected: B. J. Larmon, Ferd. T. Nebel, Oliver M. Dock, George S. Lott, and Horace Todd. The following officers were elected: Ferd. T. Nebel, president and treasurer; B. J. Larmon, vice-president; and Oliver M. Dock, secretary.

A. Milne & Co., 745 Washington St., New York City, importers of iron and steel, have placed on the market a new type of non-magnetic material known as "Swedelec." This material combines high permeability with low hysteresis loss. It is of special value to manufacturers of electrical relay coils, railway signals, telephone switchboard equipment, radio speakers and transformers, X-ray equipment, and similar apparatus.

Roller-Smith Co., 233 Broadway, New York City, manufacturer of electrical instruments and circuit-breakers, is now represented in the states of Alabama, Florida, Georgia, North Carolina, and South Carolina by H. D. Stier, 101 Marietta St., Atlanta, Ga. The H. N. Muller Co., First National Bank Building, Pittsburgh, Pa., represents the company in western Pennsylvania, West Virginia, and the Youngstown district in Ohio.

Reliance Electric & Engineering Co., Cleveland, Ohio, has moved its Pittsburgh office to new and larger quarters at 2300 Koppers Building. B. J. Ballard continues as district sales manager. The company also announces the establishment of an office at 207 Richardson Building, Toledo, Ohio, to serve northwestern Ohio, northern Indiana, and southern Michigan. C. E. Stine, formerly of the Detroit office, will be in charge.

Foote Bros. Gear & Machine Co., Chicago, Ill., has appointed Max E. Landry, 202 Local Building, Oklahoma City, Okla., representative for the IXL line of gears and speed reducers in the northern half of the state of Oklahoma. The Ammex Equipment Co., 406 San Francisco St., El Paso, Texas, will serve as district representative of the company for a portion of the state of Texas, all of New Mexico, and a large part of Mexico.

Thomas Prosser & Son, 15 Gold St., New York City, is opening a branch office at 7338 Woodward Ave., Detroit, Mich. Arrangements have been made for the manufacture and servicing of tools in that city also. The company announces the appointment of the following agents for Widia metal: Lynd-Farquhar Co., 326 Congress St., Boston, Mass., and Eccles & Davies Machinery Co., Inc., 316 S. San Pedro St., Los Angeles, Cal.

Stanley Electric Tool Co., a subsidiary of the Stanley Works, New Britain, Conn., announces the purchase of the trade name, stock on hand, tools, jigs, and fixtures of the Ajax Electric Hammer Corporation, New York. The Stanley Electric Tool Co. will continue to manufacture and develop the Ajax line in the Stanley main plant at New Britain, Conn. This line of electric hammers will be known as the "Stanley-Ajax" in the future.

Cincinnati Engineering Tool Co., hitherto located at 4659 Spring Grove Ave., Cincinnati, Ohio, has just moved into the company's new plant at 1241 Knowlton St. The new building is a one-story structure, 75 by 225 feet, with a two-story office building at the front end, in which ample space for general offices and drafting-room is provided on the second floor. William H. Vockell is president, and H. C. Uihlein is secretary and treasurer of the company.

Pacific Coast Drop Forge Corporation has been formed at Los Angeles, Cal., to engage in the production of drop-forgings. A new plant is being constructed on Alameda St., near Randolph St., which will occupy two acres adjacent to the Southern Pacific Railroad. It is expected that production will begin in February. The officers of the company are as follows: President, J. C. Ballagh; secretary-treasurer, Clarence White; and vice-president and general manager, Clarence Harris.

General Electric Co. has moved the Atlantic district sales and service departments at Philadelphia from the Witherspoon Building, where they have been for twenty-two years, to the Mitten Building, Broad and Locust Sts., where they will occupy the seventeenth, eighteenth and nineteenth floors. The service departments, also formerly located in the Witherspoon Building, together with the warehousing units and the service shop, are now located in the General Electric Building at 429 N. 7th St.

Link-Belt Co., 300 W. Pershing Road, Chicago, Ill., announces that a plan has been inaugurated for the carrying of complete roller chain drives in stock at the company's various distribution points throughout the country. Roller chain drives—both wheels and chain—will now be carried in stock for immediate delivery, the same as silent chain drives have been for the last six years. The roller chain itself has long been carried in stock by distributors, but the new plan includes the sprocket wheels.

Michigan Tool Co., 147 Jos. Campau Ave., Detroit, Mich., manufacturer of metal-cutting tools, especially milling cutters and precision gear-cutting hobs, has awarded the Austin Co. a contract for the design and construction of a $300,000 plant at Carey St. and Six Mile Road, Detroit, Mich. The Michigan Tool Co. has been in need for some time of increased production facilities for its expanding business. The new plant will be of steel frame construction, partly one and partly two stories high. It will be 260 feet long by 190 feet wide.

Kinite Corporation, Milwaukee, Wis., manufacturer of "Kinite" alloy steel castings, bar stock, and the vanadium-nickel alloy "Ironite," has increased its manufacturing facilities by the addition of the Toledo foundry of the Owens-Illinois Glass Co. This foundry, in addition to providing quicker service to "Kinite" and "Ironite" customers in Detroit, Toledo, and surrounding territories, will also make gray iron castings and "Ironite" castings for the three Owens-Illinois glass plants in West Virginia. The Milwaukee Kinite foundry will be operated as usual.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has recently added a unit to its plant at 1600 E. Euclid Ave., Detroit, Mich., which makes available 36,000 square feet of floor space for the storing and dispatching of steels. The new building is 120 by 300 feet, with facilities for the inside loading of freight cars. Five cranes will move material from all parts of the building to the transfer bay, where another crane will load it on the cars. With a view to providing for future expansion, ground space has been reserved which will give an ultimate additional area of 110,000 square feet.

Associated Alloy Steel Co., Inc., has been formed at Cleveland, Ohio, to sell exclusively the corrosion-, heat-, and wear-resisting alloy steels produced by the Timken Roller Bearing Co., the Sharon Steel Hoop Co., and the Ludlum Steel Co. These products include Nirosta, Nitralloy, and stainless steels. The active management will be under the direction of David B. Carson, vice-president and treasurer, formerly sales manager of the Development Division of the Central Alloy Steel Corporation. H. G. Batcheller, vice-president of the Ludlum Steel Co., will be president of the new company.

Eclipse Counterbore Co., 7410 St. Aubin Ave., Detroit, Mich., announces that at the annual meeting of the stockholders, Judson Bradway, R. G. Michell, Wesson Seyburn, and M. M. Michell were re-elected directors; Judson Bradway was elected president; Wesson Seyburn, vice-president; and R. G. Michell, seretary-treasurer and general manager. A. C. Warn continues in the capacity of assistant general manager in charge of production. Mr. Seyburn was reappointed director of sales. The company has just completed an addition to its plant, resulting in an increase of 75 per cent in floor space and 65 per cent in machine capacity.

John Bath & Co., Worcester, Mass., manufacturers of ground thread taps, thread gages, internal micrometers, thread chasers, and thread rolling dies, announce that the company's sales in Michigan, Illinois, Indiana, and Wisconsin will be handled directly from offices located at 803 Fisher Building, Detroit, Mich., and 2150 Chicago Daily News Building, Chicago, Ill. Frank A. Ford will be in charge of these offices as western sales manager, with Peter Collins handling the Detroit territory; H. E. Richmond, Michigan outside of Detroit; and L. T. Bohnet and E. G. Doran, the states of Indiana, Illinois, and Wisconsin.

Sivyer Steel Casting Co., Milwaukee, Wis., and the Nugent Steel Castings Co., Chicago, Ill., have been consolidated. Both of these concerns have been very active in the development of new alloy steel castings to meet special conditions. The consolidation of the companies will provide greater and more flexible facili-

4 Reasons Why WETMORE Reamers Cut Production Costs

Wetmore Adjustable Six-blade Standard Finishing Reamer with arbor integral.

Production men in many of the largest plants are specifying Wetmore Adjustable Reamers because Wetmores have proved — on actual tests — that they do *better, more accurate work at less cost.* Here are four features that make Wetmore the reamer preferred by men who know what it can do:

Adjustments to the thousandth of an inch can be made in less than a minute. In fact, the Wetmore is the quickest and easiest adjusting reamer made.

Solid alloy steel body, heat-treated, guaranteed against breakage.

Left Hand Angle Cutting Blades that prevent digging in, chattering and scoring while backing out. Shearing effect of blades increases life of cutting edge.

No grinding arbor required for regrinding. Wetmore Reamers can be reground on their original centers.

Wetmore Adjustable Six-blade Standard Finishing Reamer with arbor separate.

Wetmore Blades are carried in stock for all types of Wetmore Reamers. Best high-speed steel, ground to thickness, length, and on seat. In ordering, give type and size of reamer and whether reamer is to be used on steel, cast iron, or bronze, etc.

Give a Wetmore Reamer a trial on a good stiff job and compare its work with that of reamers you've been using. You be the judge — and we'll rest our case with you.

Send for new catalog No. 29, showing the full line of Wetmore Adjustable Reamers.

WETMORE REAMER CO.
60 27th Street, Milwaukee, Wisconsin

WETMORE ADJUSTABLE REAMERS
"THE BETTER REAMER"

ties for the handling of large alloy steel casting tonnages. The production capacity will be 1400 tons per month of castings in high-carbon and alloy steels. The alloy steel casting business of both foundries will be centralized in one foundry under exceptionally close control. The combined organizations will do business under the name of Sivyer Steel Casting Co., with main office located in Milwaukee.

WORTHINGTON PUMP & MACHINERY CORPORATION, 2 Park Ave., New York City, announces that the interests of the company in the California territory are now being served through the Worthington Machinery Corporation of California, Ltd., with headquarters at Los Angeles and San Francisco. H. D. Cornell, who has been president of the Worthington Machinery Corporation of Oklahoma, will be president of the new corporation. George W. Hawkins will become vice-president. The Worthington Machinery Corporation of California, Ltd., will take over the sales and engineering staff and the warehouse facilities of the Worthington Co., Inc., in California and will hereafter handle all that territory.

NILES TOOL WORKS CO., Hamilton, Ohio, announces that direct sales offices are now located at 1853 Chicago Daily News Bldg., Chicago, Ill., with A. C. Wais in charge; 227 Curtis Bldg., Detroit, Mich., with G. R. Shields in charge; 454 New York Central Bldg., New York City, with D. S. Woods in charge; and 1723 Grant Bldg., Pittsburgh, Pa., with P. C. McBeth in charge. The following sales agents have also been appointed: C. F. Bulotti Machinery Co., 829-831 Folsom St., San Francisco, Cal.; Hallidie Machinery Co., 2242 First Ave. South, Seattle, Wash.; D. S. Mair Machinery Corporation, 505 Esperson Building, Houston, Tex., and 4521 Edmondson Ave., Dallas, Tex.; and Pratt & Whitney Co., Birmingham, Ala.

STANLEY ELECTRIC TOOL CO., New Britain, Conn., a subsidiary of the Stanley Works, announces that the electrically and air operated saws for cutting wood and stone that were formerly manufactured by the CROWE SAFETY SAW CO., INC., Cincinnati, Ohio, are now made by the Stanley Electric Tool Co. The company is planning to install sales and service stations in New York, Philadelphia, Cincinnati, Detroit, and Chicago. The sale of Stanley electric tools which has previously been conducted by the Stanley Rule and Level Plant, has been taken over by the Stanley Electric Tool Co's. own selling organization. The officers of the company are: L. M. Knouse, president; Cedric Powers, vice-president; H. W. Blackman, secretary; L. W. Young, treasurer; and R. W. Chamberlain, sales manager.

YALE & TOWNE MFG. CO., Stamford, Conn., has added a Stuebing hand lift truck manufacturing division to the Philadelphia branch of the company at 4530 Tacony St. A four-story concrete building has been equipped with modern production machinery for the manufacture and assembly of the complete line of Stuebing hand lift trucks and skid platforms. T. T. Ludlum, formerly in charge of the Holyoke, Mass., branch, will have charge of production, and R. L. Higgins will handle all sales. The company also announces the opening of a sales office at Syracuse, N. Y., Room 534 Gurney Bldg., for the sales and service of Yale electric industrial trucks, tractors, trailers, Stuebing hand lift trucks, and skid platforms. H. R. Bungay, Jr., will be in charge of the office.

P. H. & F. M. ROOTS CO., Connersville, Ind., manufacturer of rotary positive blowers, pumps, and meters, has been merged with the STACEY ENGINEERING CO., Columbus, Ohio. The new organization includes, in addition to the Roots and the Stacey Engineering companies, the Connersville Blower Co., Connersville, Ind.; the Wilbraham-Green Blower Co., Pottstown, Pa.; and the Stacey Brothers Gas Construction Co., Cincinnati, Ohio. Colonel C. A. Thompson has been elected president; Corwin Abbott, vice-president and general manager; F. S. Heath, vice-president; and E. G. Meeks, secretary and treasurer. Charles T. Gordon will continue as general superintendent. E. D. Johnston, former president, retires from active business. All the companies involved in the merger will maintain their separate identities and organizations and will continue to operate separately until the final plans of the merger are consummated.

NORTON CO., Worcester, Mass., manufacturer of grinding wheels and grinding machines, is building a new grinding wheel manufacturing plant at Welwyn, Garden City, Hertfordshire, England, and also a new service building in Chicago, Ill. Welwyn was selected as the location of the English plant because it is a model industrial community located about twenty miles north of Kings Cross, London, on the main line of the London and Northeastern Railroad. The initial group of buildings includes a power house, a one-story kiln building with monitor, a four-story manufacturing building, and a two-story building for offices and inspection, packing, and shipping departments. The total floor space of the buildings is approximately 3 acres. The new service building in Chicago is located at the corner of 47th Place and Turner Ave. It is a one-story structure 121 by 221 feet. Future plans call for two- and three-story additions to this building.

COMING EVENTS

MARCH 3-5—National Management Congress, sponsored by the American Society of Mechanical Engineers, to be held at the Hotel Stevens, Chicago, Ill. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MARCH 5-6—Industrial Marketing Conference to be held by the Industrial Marketing Division of the American Management Association at the Blackstone Hotel, Chicago, Ill. Further information may be obtained from C. R. Cary, vice-president in charge of sales, Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

MARCH 5-7—National Materials Handling Meeting, sponsored by the American Society of Mechanical Engineers, to be held at the Hotel Stevens, Chicago, Ill. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MARCH 19—Regional Meeting of the American Society for Testing Materials at the Book-Cadillac Hotel, Detroit, Mich. C. L. Warwick, secretary-treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

MARCH 20—Annual meeting of the Electric Hoist Manufacturers' Association at Pittsburgh, Pa. E. Donald Tolles, secretary-treasurer, 165 Broadway, New York City.

APRIL 5-9—Fiftieth Anniversary Celebration of the American Society of Mechanical Engineers in New York and Washington, D. C. For further information address Calvin W. Rice, secretary, 29 W. 39th St., New York City.

APRIL 7-12—Annual convention and exposition of the American Oil Burner Association at the Hotel Stevens, Chicago, Ill. Executive secretary, Harry F. Tapp, 342 Madison Ave., New York City.

APRIL 8-9—Aeronautic Meeting of the Society of Automotive Engineers at Detroit, Mich. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

MAY 1-3—Annual meeting of the American Gear Manufacturers' Association to be held at the Hotel Gibson, Cincinnati, Ohio. T. W. Owen, secretary, American Gear Manufacturers' Association, 3608 Euclid Ave., Cleveland, Ohio.

MAY 12-16—Convention and exhibition of the American Foundrymen's Association to be held in the Public Auditorium, Cleveland, Ohio. C. E. Hoyt, manager of exhibits, 222 W. Adams St., Chicago, Ill.

MAY 19-21—Fifth National Aeronautic Meeting, sponsored by the American Society of Mechanical Engineers, to be held at Dayton, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 21-23—National Foreign Trade Convention at Los Angeles, Cal. Secretary, O. K. Davis, National Foreign Trade Council, India House, New York City.

JUNE 6-7—Annual convention of the National Association of Foremen to be held in the Civic Auditorium and the Chamber of Commerce Building, Toledo, Ohio. Harry J. Baumker, convention secretary, 316 Tenth St., Toledo, Ohio.

JUNE 9-12—Semi-annual meeting of the American Society of Mechanical Engineers at Hotel Book-Cadillac, Detroit, Mich. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

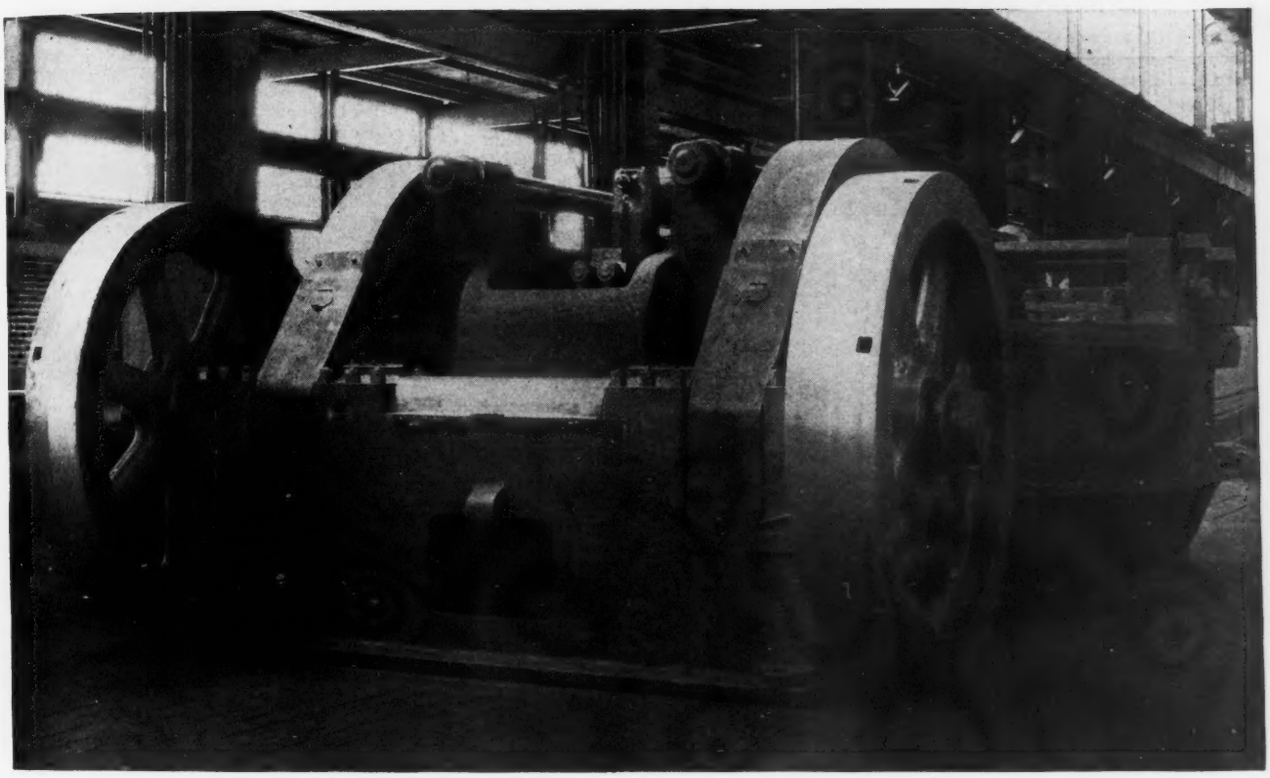
JUNE 18-25—Annual meeting of the Mechanical Division, American Railway Association, in the new auditorium at Atlantic City, N. J. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

JUNE 18-25—Exposition of railway supplies and equipment to be held under the auspices of the Railway Supply Manufacturers' Association at Atlantic City, N. J. J. D. Conway, secretary-treasurer, 1841 Oliver Building, Pittsburgh, Pa.

JUNE 23-27—Annual meeting of the American Society for Testing Materials at Haddon Hall, Atlantic City, N. J. C. L. Warwick, sec-

AJAX

TRADE MARK REG.



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WHERE power is a determining Factor, Ajax Heavy Duty Upsetting Forging Machines are the logical choice.

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retary-treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

AUGUST 24-29 — Third International Congress of Applied Mechanics to be held at the Royal Technical Institute, Stockholm, Sweden. Further information may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

SEPTEMBER 22-26 — Annual convention and exposition of the American Society for Steel Treating in Chicago, Ill. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

DECEMBER 1-6—Ninth National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City.

DECEMBER 1-6—Fifty-first annual meeting of the American Society of Mechanical Engineers in the Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

NEW BOOKS AND PUBLICATIONS

COMPARATIVE PROPERTIES OF WROUGHT IRON MADE BY HAND PUDDLING AND BY THE ASTON PROCESS. By Henry S. Rawdon and O. A. Knight. 40 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper No. 124 of the Bureau of Standards. Price, 30 cents.

MECHANICAL WORLD YEAR BOOK FOR 1930. 348 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1/6, net.

This is the 1930 edition of a well-known little mechanical handbook. Each year this handbook is brought up to date through revisions and the addition of new material. In the 1930 edition the sections on steam engines, steam turbines, condensers, and rope driving have been revised and rewritten. Also, the latest steam tables have been incorporated, and a rearrangement of contents has been made. The usual features of this work have been retained, such as the classified buyers' directory in four languages—English, French, Spanish, and German.

THE BALANCING OF ENGINES. By W. E. Dalby. 321 pages, 6 by 9 inches. Published by Longmans, Green & Co., 55 Fifth Ave., New York City. Price, $8.40.

This is the fourth edition of a book dealing with the balancing of engines. It covers both steam and internal combustion engines. The material is divided into ten chapters covering the following subjects: Addition and subtraction of vector quantities; balancing of revolving masses; balancing of reciprocating masses—long connecting-rods; balancing of locomotives; secondary balancing; estimation of the primary and secondary unbalanced forces and couples; vibration of supports; vibration of railway bridges; motion of the connecting-rod; and balancing of internal combustion engines.

AIRPLANE MECHANICS' RIGGING HANDBOOK. By Rutherfurd S. Hartz and Elzor E. Hall. 267 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $3.50.

This book is a manual of daily operating practice, covering the rigging maintenance, inspection, and repair of airplanes. It tells how to get an airplane into flying condition and how to keep it that way. It explains in non-technical language the work of the airplane mechanic, showing how each operation should be done and the reasons why. In addition to the matter on rigging, information is included on fabric, wood parts, metal fittings, wire, and dopes and doping. One of the features of the book is a list of questions following each chapter. The information presented is the result of the authors' years of experience in the Army Air Corps schools and in various civilian institutions.

PROCEEDINGS OF THE THIRTY-SECOND ANNUAL MEETING OF THE AMERICAN SOCIETY FOR TESTING MATERIALS. Part I, 921 pages, 6 by 9 inches. Part II, 1016 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price for each part, $6, bound in paper; $6.50, bound in cloth; and $8, in half leather binding.

Part I of the proceedings contains the annual reports of the various committees and an outline of the new and revised tentative standards. Part II contains a reprint of the technical papers, with discussion, including a symposium on physical properties of cast iron and one on mineral aggregates, as well as results of investigations in the field of engineering materials, together with research problems involved in cohesion and atomic structure, the fatigue of metals, and corrosion-fatigue of metals.

NEW CATALOGUES AND CIRCULARS

CENTRIFUGAL PUMPS. Blackmer Pump Co., Grand Rapids, Mich. Circular announcing Blackmer centrifugal pumps.

STEELS. Heppenstall Co., Pittsburgh, Pa. Circular reproducing clippings relating to the electric induction process of producing steel.

THREAD GAGES. Jones & Lamson Machine Co., Springfield, Vt. Bulletin on the J & L Hartometer for detecting errors in screw threads.

JET CONDENSERS. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet describing in detail the construction and application of jet condensers.

WIRE FORMING MACHINES. Baird Machine Co., Bridgeport, Conn. Circular illustrating Baird wire formers, tool and die grinders, and tilting tumblers.

ARC-WELDING EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Arc-welding data book No. 11, treating of the arc-welding of cast iron.

PULLEYS. American Pulley Co., Philadelphia, Pa. Circular illustrating typical examples of American "Sprucolite" pulleys and American pressed-steel shafting pulleys.

AUTOMATIC SCREW MACHINES. Davenport Machine Tool Co., Inc., Rochester, N. Y. Circular illustrating and describing the new Davenport five-spindle automatic screw machine.

TWIST DRILLS. Morse Twist Drill & Machine Co., New Bedford, Mass. Circular illustrating examples of the Morse line of high-speed and carbon drills, cutters, reamers, taps and dies, etc.

STEEL BEARINGS. Fredericksen Co., Saginaw, Mich. Leaflet entitled "What Can this New Sabeco-ed Steel Bearing Do for You?", descriptive of Sabeco bearing metal and its advantages.

ELEVATOR DRIVE. H. W. Caldwell & Son Co., 2410 W. 18th St., Chicago, Ill. Booklet No. 1086, announcing a new standardized drive for bucket elevators requiring from 3 to 15 horsepower.

NICKEL STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Pamphlet No. 14 of a series on nickel steel data and applications, dealing with the manufacture of nickel steel plate.

CHUCKING MACHINES. Potter & Johnston Machine Co., Pawtucket, R. I. Circular illustrating and describing the features of the Potter & Johnston No. 5-D "Power-Flex" automatic chucking machine.

ELECTRIC EQUIPMENT. Electric Controller & Mfg. Co., Cleveland, Ohio. Circular descriptive of the use of E C & M time-current controllers for operating cranes, hoists, and mills in iron and steel plants.

BEAM CLAMPS. General Electric Co., Schenectady, N. Y. Circular illustrating G-E beam clamps for attaching all forms of outdoor devices to structural steel members and for fastening steel members to each other.

TAPPING MACHINES. Western Machine Tool Works, Holland, Mich. Circular 8000, illustrating and describing Garvin No. 3-B heavy-duty automatic tapping machine equipped with Timken tapered roller bearings.

GEAR GRINDING MACHINES. National Tool Co., Madison Ave. at W. 112th St., Cleveland, Ohio. Circular illustrating the National-Cleveland spur and helical gear grinding machine and examples of work done on it.

MILLING MACHINES. Kearney & Trecker Corporation, Milwaukee, Wis. Bulletin entitled "Milling Faster for Tractor Power," descriptive of the use of Kearney & Trecker milling machines in the plants of tractor builders.

DIAL MICROMETERS. B. C. Ames Co., Waltham, Mass. Circular descriptive of the new Ames "Dial Mike," which is a pocket micrometer equipped with a dial, for measuring conveniently round, flat, and odd-shaped parts.

ROLLING MACHINES. McKinney Tool & Mfg. Co., 1688 Arabella Road, Cleveland, Ohio. Bulletins 50 and 51, illustrating and describing, respectively, the McKinney Type C and Type B roller die forming machines for forming sheet-metal parts.

REAMERS AND TOOLS. Millersburg Reamer & Tool Co., Millersburg, Pa. Catalogue 9A, containing data, including dimensions, prices, etc., covering the line of reamers, milling cutters, end-mills, and twist drills made by the company.

SHEARS. United Machine Tool Corporation, 75 West St., New York City. Catalogue 3, entitled "Plate Slitting, Trimming, and Beveling Shears," illustrating and describing a line of shears built by Schulze & Naumann, Koethen, Anhalt, Germany.

MATERIAL HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the application of the Cleveland overhead tramrail system in the textile industry.

GEARS. Grant Gear Works, Boston, Mass. Catalogue and price list No. 53 of stock and special gears for industrial use, including spur, bevel, and miter gears, worm-gears, internal gears, sprockets, spiral and herringbone gears, and speed reducers.

WELDING EQUIPMENT. General Electric Co., Schenectady, N. Y. Circulars GEA-874E, 875E and 876D, illustrating and describing, respectively, Type WD-200A arc welders; Type WD-300A arc welders; and Type WD-400A arc welders.

SPRINGS. Raymond Mfg. Co., Corry, Pa. Bulletin containing illustrations and directions for specifying extension and torsion springs and compression springs. The bulletin also contains notes on spring materials and design and a complete spring design chart.

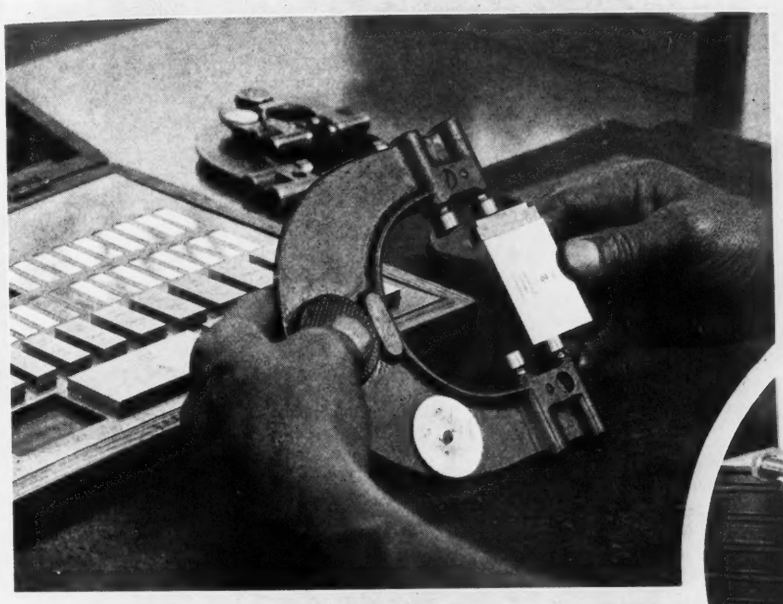
ELECTRIC TOOLS. Black & Decker Mfg. Co., Towson, Md. Catalogue covering the Black & Decker line of portable electric tools, containing specifications for electric drills, saws, hammers, sanders, tappers, grinders, screwdrivers, valve refacers, etc.

WELDING EQUIPMENT. Aluminum Co. of America, Pittsburgh, Pa. Pamphlet entitled "The Welding of Aluminum and its Alloys," containing detailed information regarding the apparatus used and the correct procedure to be followed in welding aluminum.

TENSION AND COMPRESSION TESTING MACHINES. Herman A. Holz, 167 E. 33rd

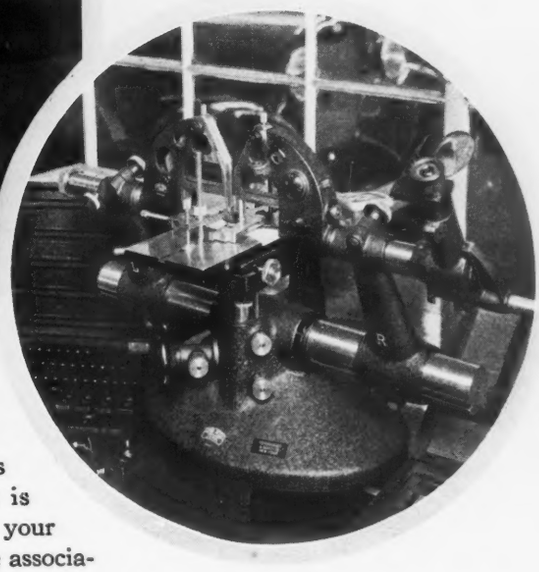
JOHANSSON GAGES

bring the world's standard of measurement to your production line



LEFT: *Checking Snap Gage with Johansson Gage Blocks.*

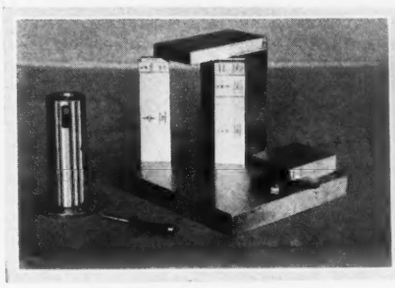
BELOW: *Setting inside optometer with Johansson Gage Blocks.*



RECTANGULAR blocks of hardened, stabilized steel set the standards of precision production throughout the world today. Manufacturers in many lands rely on them to protect the quality of their output. They are in constant use at the Bureau of Standards, Washington; the National Physical Laboratory, London; the Bureau International des Poids et Mesures, Paris; and at similar institutions in all the principal nations. They are Johansson Gage Blocks.

In 1897, Mr. C. E. Johansson conceived the idea of combining different sized gage blocks to make a much greater number of gage sizes. That same year saw the first set designed and completed. Ten years' work brought the gage blocks to an accuracy of one hundred-thousandth of an inch. Later it was increased to eight, four and two millionths of an inch. Today, this unparalleled precision is available for use in your factory by reason of the association of Mr. Johansson with the Ford Motor Company.

Johansson Gage Blocks, singly, or in combination, will make more than 1,000,000 different sized gages in consecutive steps from four-hundredths of an inch (.04″) up to more than one hundred inches. Because they adhere so strongly, these gage block combinations are virtually solid steel blocks. This feature makes them the most flexible and convenient, as well as the most accurate measuring tools ever devised. They will give the same result any number of times with any number of mechanics.



Checking production gage

The precision of the Johansson Gage Blocks will help keep the gages and tools on your production line within specified working limits and will cut costs by eliminating expensive errors in measurement. There is a set to meet all requirements, no matter what your product or how its character may change.

C. E. JOHANSSON, *Inc.*

Division of **FORD MOTOR COMPANY**

Detroit, Michigan

Write direct or to your Mill Supply Dealer

St., New York City. Bulletin containing a comparison of the accuracy of load indications on Amsler hydraulic and lever types of tension and compression testing machines.

ELECTRIC TOOLS. Schauer Machine Co., 905-907 Broadway, Cincinnati, Ohio. Catalogue 30, containing data on the line of "Ideal" portable and stationary electric tools made by this company, which includes drills, screwdrivers, nut-setters, grinders, and flexible shaft outfits.

SMALL TOOLS. National Tool Co., Cleveland, Ohio. Catalogue H, covering the complete line of small tools made by this company, including gear and milling cutters, gear shaper cutters, hobs, and special tools. Tables of dimensions and prices are included for the various tools.

ALUMINUM SCREW MACHINE PRODUCTS. Aluminum Co. of America, Pittsburgh, Pa. Pamphlet dealing with aluminum screw machine products and their use in various industries. The booklet includes tables of stock sizes and specifications, as well as various other useful data.

PRECISION LEVELS. Gray Instrument Co., 64-70 W. Johnson St., Germantown, Philadelphia, Pa. Bulletin A-5, illustrating and describing a complete line of precision levels suitable for machine shop and tool-room use as well as for other purposes where accurate levels are required.

WELDING MACHINES. Acme Electric Welder Co., 5621A Pacific Blvd., Los Angeles, Cal. Pulletin entitled "The Acme of Metal Joinery," illustrating and describing the Acme line of "Hot Spot" welders. The bulletin also illustrates a butt-welding attachment for spot-welding machines.

METAL PARTS WASHING MACHINES. Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. Catalogue containing data on Colt "Autosan" metal parts cleaning and drying machines. The booklet shows blueprints of a series of Colt "Autosan" machines in both conveyor and revolving types.

STEEL FACTORY EQUIPMENT. Standard Pressed Steel Co., Jenkintown, Pa. Bulletin 417, illustrating and describing Hallowell-Westric steel work benches and tables, which are equipped with tops made from a new material known as "Westric," which is claimed not to warp, crack, or splinter.

WELDING EQUIPMENT. Linde Air Products Co., 30 E. 42nd St., New York City. Booklet entitled "Oxwelded Construction for Modern Piping Services," containing facts relating to the use of the oxy-acetylene process in the fabrication of steel and wrought-iron piping systems for all purposes.

SAW SHARPENERS. Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y. Leaflet describing the new No. 4 automatic saw sharpener made by this concern, which will accommodate metal-cutting saws from 3 to 30 inches in diameter. The operation of the machine is described, and important specifications are included.

GRINDING MACHINES. Cincinnati Grinders, Inc., Cincinnati, Ohio. Booklet entitled, "Meet 1930 with These New Precision Grinding Applications," illustrating typical installations of Cincinnati cylindrical grinding machines, both of the center and centerless types. Important data regarding the job is given in each case.

THREAD TOOLS. Rivett Lathe & Grinder Corporation, Brighton District, Boston, Mass. Bulletin 110-A, illustrating and describing the Rivett improved thread tool, which is an attachment for any screw-cutting engine lathe. The bulletin also contains instructions for the grinding and use of this tool and for grinding the cutters.

OPTICAL INSTRUMENTS. Bausch & Lomb Optical Co., 662 St. Paul St., Rochester, N. Y. Catalogue entitled "Precision Through Optical Methods," illustrating and describing a number of precision optical instruments, including drill gages, bevel protractors, indexing devices, centering levels, comparators, profile gages, and thickness gages.

MILLING AND DRILLING MACHINES. Ingersoll Milling Machine Co., Rockford, Ill. Circular illustrating the complete production line-up made by this company for milling, boring, drilling, and tapping cylinder blocks. The thirteen machines used for this job are illustrated, and details concerning the work done on each machine are given.

MILLING CUTTERS AND REAMERS. Pratt & Whitney Co., Hartford, Conn. Lists Nos. 318, 326, 355, and 458 containing data on staggered tooth milling cutters; half-side milling cutters; shell end-mills; and helical taper pin reamers; respectively. Each circular shows an application of the type of cutter described and gives a list of sizes and prices.

PRESSED-METAL STAMPINGS. Geuder, Paeschke & Frey Co., St. Paul Ave. and 15th St., Milwaukee, Wis. Booklet showing the possibility of using drawn sheet metal for a wide variety of parts. Examples of parts that can be economically produced in this way are illustrated. The bulletin includes a comparative table of thicknesses of various sheet metals.

ELECTRIC CONTROL APPARATUS. Cutler-Hammer, Inc., 166 Twelfth St., Milwaukee, Wis. Booklet entitled "Practical Pointers on the Selection of Motor Control," outlining the principal features to be considered in selecting motor control. The booklet tells how to choose control to suit the load of the motor, and how to select control for both direct-current and alternating-current motors.

MANAGEMENT ENGINEERING. Elliott Service Co., 242 W. 55th St., New York City. Wall chart entitled "How and Where to Cut Waste." The chart is divided into six sections dealing with waste of time; waste of materials; waste of machinery and equipment; waste of electric current, steam, compressed air, water, heat, and gas; waste of space; and waste and cost of accidents.

GRINDING MACHINES. Norton Co., Worcester, Mass. Pamphlet entitled "Grinding of Cemented Tungsten Carbide." This pamphlet comprises a complete little handbook on grinding cemented tungsten carbide. It deals with the properties of the metal, grinding resistance, methods of grinding, set-up of work, pressure and feed, wet grinding, lapping and honing, and selection of wheels.

PLANER MOTORS. Reliance Electric & Engineering Co., 1042 Ivanhoe Road, Cleveland, Ohio. Bulletin 205, descriptive of Reliance Type T heavy-duty planer motors for reversing service. In addition to describing the motor, the bulletin also tells what control is required and how it operates. The illustrations show a variety of applications of this type of motor to heavy-duty planers.

ALLOY STEELS. Sivyer Steel Casting Co., Milwaukee, Wis. Circular of Sivyer alloy and special carbon electric furnace steels, containing tables listing the physical properties of these steels after annealing and heat-treating. Bulletin containing the reprint of an article from the *Iron Age* entitled "Production Control in a Steel Foundry," descriptive of the practice of the Sivyer Steel Casting Co.

ELECTRIC INSTRUMENTS. Roller-Smith Co., 233 Broadway, New York City. Bulletin 300, covering various types of instruments for resistance measurements, including Types COM, GOM, and SOM ohmmeters and Type HTD circuit tester. Bulletin 210, covering portable direct-current ammeters, milli-ammeters, voltmeters, milli-voltmeters, volt-ammeters, galvanometers, circuit testers, shunts, multipliers, etc.

BENDING AND STRAIGHTENING MACHINES. Thomas Spacing Machine Co., Fulton Bldg., Pittsburgh, Pa. Bulletin 123, illustrating the Thomas bending and straightening machine with structural steel frame, which is especially designed for bending and straightening H-columns and all structural shapes. The circular also illustrates Thomas column-facing machines and multiple drilling machines with indexing table.

POWER HAMMERS. C. C. Bradley & Son, Inc., Syracuse, N. Y. Catalogue illustrating and describing new types of Bradley power hammers. Complete specifications of the various types are included. Circular illustrating the use of Bradley power hammers in representative industrial plants throughout the country. The circular gives an idea of the variety of forging and hammering operations that can be performed with these machines.

FLEXIBLE SHAFTS. S. S. White Dental Mfg. Co., 152 W. 42nd St., New York City. Handbook designed to enable engineers and designers to select flexible shafts to fit their specific needs and to make proper applications. The book is divided into five sections covering the following subjects: Applications of flexible shafts; characteristics and construction of flexible shafts; drive shaft ends; casings and casing ends; and shaft and casing combinations.

SMALL TOOLS. J. T. Slocomb Co., Providence, R. I. Catalogue 17, covering the line of machinists' tools made by this concern. Data, including prices, are given for the various styles of micrometer calipers, micrometer gages, and center drills. The last part of the publication, designated as the measuring book, contains suggestions regarding accurate measuring in machine construction by the use of micrometer calipers and gives various tabulated matter, such as allowances for fits, decimal equivalents, tap drill sizes, speeds for center drills and twist drills, etc.

LATHES. Porter-Cable Machine Co., Syracuse, N. Y. Catalogue entitled "Turning with Tungsten Carbide," containing information on the nature of this new cutting material, its characteristics, field of application, advantages, and method of use. The second part of the catalogue is devoted to a description of the "Carbo-Lathe," designed especially for the use of tungsten-carbide tools. The various parts of the machine are illustrated and described in detail, and examples of multiple tooling are also shown. A description of the Porter-Cable high-speed production lathe is included.

LATHE ATTACHMENTS. South Bend Lathe Works, 771 E. Madison St., South Bend, Ind. Bulletin 77, describing and illustrating the many attachments used with New Model South Bend lathes. The bulletin shows how these lathes can easily be converted into milling machines, keyway cutting tools, precision grinders, jig boring and spacing tools, gear cutters, and turret lathes. Among the attachments described are collet chucks, taper attachments, electric grinder attachments, relieving attachments, speed reducing attachments, milling and keyway cutting attachments, jig boring and spacing attachments, gear-cutting attachments, turrets, tool-slides, thread indicators, tailstocks, etc.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletin GEA-987A, describing in detail the features of construction of heavy-duty station oil circuit breakers for indoor service on systems of large capacity. Bulletins 714B, 881C, 1009B, 1158A, 1177A, 1191, and 1193, illustrating and describing, respectively, direct-current mill motors for steel mill auxiliaries, shovels, dredges, cranes, hoists, and bridges; Type WD-200A gas-engine-driven arc welding machines, Type WD-300A gas-engine-driven arc welding machines; chart for determining the cost of operating electric appliances and motors; oil immersion heaters; synchronous motors; and automatic switching equipment.